THE FUTURE OF
PLUG COMPATIBLE COMPUTER PRODUCTS

INPUT

ABOUT INPUT

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INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

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THE FUTURE OF
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A MULTICLIENT STUDY

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1 INTRODUCTION

I INTRODUCTION

- The primary objectives of this study were to evaluate certain key issues and their impact on the future of so-called plug compatible computer products including mainframes, peripherals, and terminals.

- The basic specifications for the study were established jointly by the initial sponsoring clients and INPUT.

- Issues covered include:

  - The degree to which plug compatible equipment will be accepted in the future by users in various CPU size categories.

  - IBM's current and future product strategies and their likely impact on plug compatible product offerings.

  - Evaluation of opportunities for plug compatible vendors.

- The research for this study was predicated upon two sets of questionnaires, one for vendors and one for users, developed by INPUT with client assistance.

- Interviews were conducted by telephone and on-site.

  - All of the 150 user interviews were conducted by telephone.

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- All 18 vendor interviews were conducted on-site.

- Telephone screening methods were employed to arrange the on-site vendor interviews with senior people who could speak with authority regarding their PC/PCM product line, both present and future.

- The end user interviews were selected on a random sample basis within industry sectors and further refined to achieve sampling as measured by installed CPU size, as shown in Exhibit I-1.

  - Fifty users from each of three size categories were selected:

    . Small range is defined as GSD (IBM General Systems Division) type products, i.e., less than a System 370 Model 125 installed.

    . Medium range is defined as System 370 Model 125 to System 370 Model 148.

    . Large Scale is defined as System 370 Model 158 or larger.

- Since the study relates to PC/PCM equipment, only those users were selected whose largest installed CPU was an IBM product.

- Vendor on-site interviews required up to three hours to complete. User telephone interviews ranged from thirty minutes to one and one-half hours each.

- Vendors were selected to achieve a balance of PC/PCM, terminal and software companies.

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EXHIBIT I-1

ANALYSIS OF RESPONDENT USERS BY CPU SIZE CATEGORY AND INDUSTRY SECTOR

INDUSTRY	SMALL RANGE USERS			MEDIUM RANGE USERS			LARGE SCALE USERS			TOTAL	
	NUMBER OF RESPONDENTS	PERCENT OF SIZE	PERCENT OF TOTAL	NUMBER OF RESPONDENTS	PERCENT OF SIZE	PERCENT OF TOTAL	NUMBER OF RESPONDENTS	PERCENT OF SIZE	PERCENT OF TOTAL	NUMBER OF RESPONDENTS	PERCENT OF TOTAL
DISCRETE MANUFACTURING	13	26%	8.7%	13	26%	8.7%	5	10%	3.3%	31	20.7%
PROCESS MANUFACTURING	6	12	4.0	9	18	6.0	10	20	6.7	25	16.7
TRANSPORTATION	1	2	0.7	1	2	0.7	5	10	3.3	7	4.7
MEDICAL	–	–	–	4	8	2.7	–	–	–	4	2.7
SERVICES	4	8	2.7	1	2	0.7	2	4	1.3	7	4.7
UTILITIES	–	–	–	2	4	1.3	4	8	2.7	6	4.0
RETAIL	7	14	4.7	–	–	–	2	4	1.3	9	6.0
BANKING	13	26	8.7	6	12	4.0	8	16	5.3	27	18.0
WHOLESALE	5	10	3.3	3	6	2.0	2	4	1.3	10	6.7
OTHER	–	–	–	–	–	–	1	2	0.7	1	0.7
INSURANCE	1	2	0.7	6	12	4.0	1	2	0.7	8	5.3
FEDERAL GOVERNMENT	–	–	–	–	–	–	5	10	3.3	5	3.3
STATE & LOCAL GOVERNMENT	–	–	–	3	6	2.0	2	4	1.3	5	3.3
EDUCATION	–	–	–	2	4	1.3	3	6	2.0	5	3.3
TOTAL	50	100%	33.3%	50	100%	33.3%	50	100%	33.3%	150	100%

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- The interviews concentrated on determining representative user and vendor attitudes and experience. There was no attempt made to construct a statistically valid sample. Accordingly, other market related information developed by INPUT, or available in the public domain, was used to formulate some of the conclusions presented in the study.

- Specific client recommendations, other than those of a general nature are intentionally excluded from this report. This information is contained in separate documents prepared for each initial sponsor on a confidential basis.

- Client inquiries and comments on the study's findings are invited.

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II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

A. GENERAL CONCLUSIONS

- Regardless of the number of assaults made by competition against IBM's user base, IBM continues to dominate the market.

- The 1970s saw the successful emergence of the plug compatible (PC) vendor. Initially led by peripheral vendors like Memorex, Storage Technology Corporation, and to a lesser extent Control Data Corporation, the PC market took on new dimensions with Amdahl's "V" Series CPU announcement. Spurred on by the overall success of the PC peripheral and mainframe vendors, and coupled with an expanding market demand, additional PC manufacturers entered the marketplace by announcing compatible CPU offerings directed at IBM's medium-large base.

- IBM responded to this intrusion with vengeance. A series of strategic counter actions were employed by IBM encompassing major price reductions on installed equipment, new product announcements, increased purchase option credits to encourage purchase of existing lease units, and the provision for future trade-in allowances for purchase of new products.

- All of these IBM actions had a telling effect upon the PC manufacturers. Unquestionably, the single key strategy initiated by IBM to thwart competition was that of price reductions for both new products and current products with

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particular emphasis on CPUs. As a result, new industry price/performance curves were established and competition was forced to respond to IBM's aggressive pricing policies.

- In the final analysis, IBM has emerged the victor although the short term price of victory has been substantial. IBM's earnings have eroded throughout 1979 and, possibly, through the first half of 1980. The PC mainframe and peripheral vendors have experienced even greater problems, examples of which are the demise of Itel and reduced earnings (approaching 50%) for both Amdahl and Memorex. In addition, Memorex has publicly displayed a "for sale" sign indicating that a merger or acquisition will probably be required for them to remain viable in the long term.

- In retrospect, IBM overreacted to the implied threats of the PC vendors. IBM's newly announced prices (higher rather than lower) acknowledges that no serious long term threat exists from the PC community.

- What IBM has done, in fact, is to establish "de facto" gross margins for the PC industry. The so-called IBM price umbrella no longer exists. If PC vendors wish to compete against IBM with plug compatible products, they will have to accept very small margins.

- For the PC vendors, the sizable IBM market opportunity will continue to be a lucrative lure. A major issue of concern to end users is the effect of these reduced margins on the ability of the PC vendor to provide quality maintenance and system support. PC vendors must be prepared to address this issue in depth.

- Plug compatible equipment vendors have reacted to IBM announcements with very little creativity. Given the continued price/performance squeeze, considerably more innovation will have to be forthcoming in order for these vendors to remain a viable alternative to IBM.

- Some of the bright spots in the market for PC/PCM companies center around:

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- IBM's expansion of the entire market coupled with elongated delivery schedules has opened up possible opportunities for vendors with short delivery schedules. Many of these opportunities will exist in accounts previously closed to non-IBM vendors.

- The long term success of plug compatible vendors will depend upon a marketing and service/support capability sufficiently strong to open new accounts and keep their equipment installed.

- The present market situation will also give PC/PCM companies breathing room to improve by:

  - Vertical integration of their product line and/or R&D, manufacturing, sales, and service.

  - Expanding their product offerings.

  - Preparing or acquiring software.

  - Merging or entering into joint ventures.

- The terminal market has been and will continue to be an excellent opportunity for plug compatible vendors. It presents some unique opportunities now that IBM has endorsed DDP as a concept.

  - Industry sources place the installed terminal base at the end of 1979 at approximately 500,000 units with a growth projected to 1.9 million by the end of 1984.

  - Coupled with this growth is a change in the mix of RBTs (Remote Batch Terminal). It is expected that non-programmable devices will decline at about 26% AAGR and programmable devices will increase at 12%.

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- Recent industry sources place the disk market growth at 22% from a 1978 level of $4 billion to $10.8 billion in 1983.

  - The results of the user survey conducted for this study reveal that this number is extremely low. The results of the survey, plus a special straw poll of 34 very large scale users not covered in the survey, tend to verify that the disk market will grow at at least 45% annually over the next three years.

- If these numbers prove to be accurate, there is considerable opportunity for PC vendors, because the market demand will surely outstrip IBM's production capacity.

- The software market is a major opportunity area because of the willingness of large and medium range users to acquire non-IBM software.

  - Some years ago, IBM promised simple, easy to use software. Since then, users have been inundated with the most complex software systems imaginable. With the announcement of the Series 8100 and 43XX, they again have been promised simple, easy to use software systems with a clearly defined user interface. While only time will tell the truth of these claims, the users have certainly made their position known by accepting non-IBM software.

- The new IBM approach to more firmly establish an external software level and to keep the internals classified, confused, and embedded, will allow the PC/PCM vendors to provide applications and utility packages that are superior.

- The future of OS and IMS is not clear, but no doubt IBM will provide some transformation bridges to the new systems. Most likely these programs, which IBM would not like to support for long, will run on the new hardware at less than the new price/performance levels achieved by the newer operating systems or data base management systems. If this is part of the IBM strategy,

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then several areas of opportunity will be available for PCM and software suppliers to provide upgrades at something better than IBM price/performance.

- The tape market will not be a major growth area unless present technology changes and today's required operator intervention is eliminated.

  - However, many users who have not installed tape previously are preparing to add it; not because tape is an effective media, but because of a need for backup on fixed type disks.

  - Tape will also be a viable media (with improved packing densities) for use as streamer tapes as part of a mass storage subsystem.

B. IBM STRATEGIES

- IBM will make it increasingly difficult for PCs and PCMs to compete over the next several years. There are two major reasons:

  - The production efficiency that IBM can attain due to large volume manufacturing allows them to build equipment at lower cost than anyone else.

    . Although this has been true historically, the degree to which this efficiency is achieved is more significant now than it was in past years.

    . For example, IBM has been able to settle on a single custom chip/carrier configuration that is used across a very wide product spectrum, including terminals, controllers, and peripherals, as well as mainframes.

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- IBM will stress software and service as revenue and profit generators. INPUT projects that as much as 25% of IBM's income will derive from these sources within four years, up from 5% in 1979.

  . Should IBM be able to obtain needed margins from the software, they can minimize hardware prices, making it even more difficult for PCs to compete with their traditional strategy of selling the same hardware capability at lower prices than IBM.

- With little competition from vendors who market plug compatible hardware, IBM will pursue an aggressive pricing strategy which will emphasize the "pay for what you use" philosophy.

- IBM fully intends to continue its domination of the data processing industry and to protect its national and international markets from the Japanese.

- IBM further intends to:

  - Continue to set new price/performance standards for the industry.

  - Develop new markets in DDP and rapidly expand its present markets to prevent revenue loss or stagnation due to price reductions.

  - Shift the profit center from pure hardware to unbundled software, services, and maintenance.

  - Require the user to perform more functions in the installation support or charge for this "one time free" service.

  - Embed firmware/software in scattered sections of the CPU and peripherals to hamper "look alike engineering."

  - Firmly establish SNA as the communications network and SDLC as the line protocol by the mid 1980s.

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- While IBM may have engineered their new strategy with the Japanese in mind, the effect has been felt by all domestic manufacturers.

  - The lack of detailed data on new software, hardware, and the migration path has confused the users as well as the vendors.

  - PC/PCM vendors will continue to suffer from a profit squeeze.

- As has been mentioned in several INPUT reports, there is a "window" for PC/PCM suppliers which is open for the next 16 to 18 months until IBM solves its production problems and is able to quote realistic delivery dates.

  - The future success of many vendors will depend not on their initial reaction, but their ability to sell, install, and service their present products during this timeframe.

- The PC/PCM business started because independent suppliers could provide computer products (sometimes with better performance) for less cost than IBM.

  - The market will continue to exist but will be left to those vendors who have the capability and resources to survive in a reaction market.

C. VENDOR STRATEGIES

- While there are several holes in the IBM new product line, some areas are clear and should be acted upon. Some of these are:

  - SNA and SDLC are going to be required for medium range system and terminal vendors.

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- PCMs should design "soft" machines to react to IBM systems software changes.

- PCMs should evaluate their capability to be compatible at the user interface level and consider their own operating systems as opposed to using IBMs.

- PCMs should be prepared to offer a full system and not just the CPU.

- Disk file vendors will find a ready market in 1980-1981 because of the extraordinary market growths. Thereafter, IBM's built-in adaptors and utilization of intelligent controllers will mitigate against PC vendors providing one-for-one replacable subsystems.

- All vendors should place on order those IBM devices that have an impact on their market and press for improved delivery.

  - Complete engineering analysis is the key to future compatibility.

- Systems migration is always difficult for the user unless he simply uses his new system to emulate the old.

  - Several areas of opportunity will be open for vendors who can provide an easy path for the user to migrate to a non-IBM but compatible system.

- Vendor marketing should analyze all first time users and spend considerable time and attention on those accounts where their equipment has been ordered pending arrival of a new IBM system.

- Numerous areas of opportunities will be present for vendors in DDP and SNA.

  - Neither the typical DPD salesman nor the typical user has an in-depth understanding of DDP or the complexities of SNA.

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- The Series 8100 in its Distributed Processing Programming Executive (DPPX) mode will require substantial user programming.

- While IBM will no doubt offer a massive training program, the user will still require more help to implement than the typical salesman can provide.

- Vendors who can unravel the mysteries of SNA, provide easy conversion, and highly qualified communications expertise, will find a ready and eager user audience.

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III USER SURVEY ANALYSIS

III USER SURVEY ANALYSIS

A. LARGE SCALE USERS

1. LARGE SCALE USERS, CPU TRENDS

- The recent months have brought a period of stability to the large scale users. IBM's pricing adjustments to, and coupled with, the Newport announcement indicates the 303X will continue to be IBM's prime offering until 1982. While INPUT concludes the "H" Series announcement will be made during the second half of 1980, quantity deliveries of the new series will not be realized until late 1982. Therefore, the large scale users of IBM CPUs (System/370 Model 158 and above) must rely solely upon the 303X series for the 1980-1982 period.

2. CURRENT CPU INSTALLED AND ON ORDER POSITION

- The fifty large scale CPU respondents of IBM systems presented an optimistic view for the continued use of IBM systems. (See Appendix A, Exhibit A-1: CPUs Installed Or On Order By Respondents.)

  - All 50 large scale respondents have a total of 71 IBM systems installed with 13 on order. There are no non-IBM systems in either the installed or on-order categories.

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- Forty-seven of the installed units (66%) are System/370s with only one System/370 on order.

- Twenty-four (34%) installed systems are 303X with 13 on order. The high on-order rate for 303X systems (18%, representing a combination of 3031s and 3033s) results from System/370 upgrades and additional 303Xs for multisystems operations. Only two 3032s on order are attesting to the fact that the Newport unit was required.

- The lack of non-IBM systems in the installed and on-order categories is partially attributed to the industry sample mix. The analysis of respondent users by industry (Exhibit I-1) is heavily weighted in favor of manufacturing and banking, which accounts for 56% of the sample total and historically, a loyal IBM base. Amdahl, for example, has been successful in selling to the federal government and public utilities which represents only 8% of the respondents. If PCM vendors wish to penetrate IBM's established base, a major strategic undertaking must be formulated to entice the discrete and process manufacturing industries to leave IBM's protective fold.

- As indicated from the installed and on-order totals, the majority of large scale users are satisfied to wait for IBM systems regardless of the long delivery periods.

- The PC vendors do provide very short delivery schedules (30 days for peripherals and 60-90 days for CPUs) at price/performance ratios better than those of comparable IBM products. In addition, competition for user's business has forced the PC vendors to provide short-term leases, including one year contracts, although at higher monthly lease rates. The large scale user community views these moves by the PC vendors as an equipment insurance policy should IBM falter in their delivery schedule commitments.

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3. LARGE SCALE USERS, DISK DRIVE TRENDS

- Based upon the answers supplied by the 50 respondents, IBM has supplied 73% of the installed disk units for large scale users.

- The IBM large scale user base is essentially comprised of model 33XX type units (See Appendix A, Exhibit A-2: Disk Drives Installed Or On Order By Respondents.) The 3330, 3340 and 3350 account for 97% of the installed base. Further, the 3350 represents 82% of the on-order total.

  - As expected, the large scale users have a large number of drives installed (an average of 20 drives per system).

  - The 3350 is the dominant drive and represents 47% of the installed total, followed by the 3330 with a 31% share. The 3340 follows next with 19% installed.

  - Large users continue to favor IBM's workhorse drive, the 3350. As indicated earlier, the 3350 also commands the on-order position with 74 drives or 57%.

- Analyzing the installed and on-order position for PC vendors, their comparable 33XX devices parallel IBM's success.

  - A total of 388 disk drives are installed by PC vendors or 27% of the installed base.

  - Interestingly, Itel has 62, IBM 3330 type and 98, IBM 3350 type disk drives installed. Although these are IBM drives, Itels' success can be attributed to systems leasing, which includes the long-term lease of CPUs and where peripherals are packaged as part of the contract.

  - Respondents indicated that Memorex supplied the next largest number of installed systems, 69 in number or 5% of the disk drive base.

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- Storage Technology Corporation (STC) had approximately the same installed numbers and percentages as Memorex; 60 units or 4% installed.

- The last major PC disk vendor is Control Data Corporation (CDC) with 32 units or 2%.

- Respondents indicated a minimal number of 33XX type drives on order from PC vendors; 37 units or 3% of the total installed base. The low on-order figure is understandable, for PC disk vendors can supply user demand within 30 days after receipt of order. IBM 33XX disk deliveries, for example, span 90-120 days.

4. LARGE SCALE USERS, TAPE DRIVES

- IBM's dominance in the tape drive market is obvious, (see Appendix A, Exhibit A-3: Tapes Installed Or On Order By Respondents). Large scale user respondents surveyed indicated a total of 680 tape drives installed; 429 (or 63%) are IBM equipment. The PC vendors account for 251 units which represents 37% of the installed total.

- The largest concentration of installations of IBM tape drives falls into the 43XX type category. The same is true for comparible units installed by the PC vendors.

- Large scale CPU users utilize 9.6 tape drives per system. Most respondents indicated that batch processing and serial storage needs constitute the primary applications.

- On-order magnetic tape units were practically nonexistent. Tape deliveries by IBM and the PC vendors are immediate: therefore, no long-term on-order period exists.

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5. LARGE SCALE USERS, PRINTERS

- The early success of the IBM 1403 printer established performance and quality standards for the printer industry to follow.

- Even today, the 1403 device is the favorite of EDP installations where reliability and printing clarity are important equipment decision factors. Further, 1403s are considered to be a good inflation hedge and installations are constantly looking for purchase deals.

  - IBM accounts for 80% of the installed large scale CPU user base. There are 148 printers installed (two per person) and 119 are IBM units. (See Appendix A, Exhibit A-4: Printer Equipment Installed Or On Order By Respondents.)

  - Fifty-two (35%) are 140X type units. The IBM 3211 follows closely with 45 units, or 30%.

  - The IBM 3203-5 is the replacement for the 1403, with eleven installed and six on order. The high on-order rate reflects 90-120 day delivery periods.

  - The 3800 laser printer is slowly being accepted by the large scale user installations. Currently, there are ten units installed (7%) and three on order. There are no comparable Xerox or Honeywell units installed or on order.

- The 50 respondents named only one competitor in this printer sample, Documation. In the sample, they accounted for 23 units (15%).

6. LARGE SCALE USERS, TERMINALS

- The terminal market has been a continuing opportunity for PC vendors who can supply compatible products or systems.

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- Large scale CPU users lead the pack with 12,482 units installed. IBM's installed percentage amounts to 54%, or 6,707 units. Competition has 5,775 units in place, representing the remaining 46% of the installed base (see Appendix A, Exhibit A-5: Terminals Installed Or On Order By Respondents).

  - The 327X terminal has been IBM's mainstay and the bellwether for PC vendors to follow. For the IBM user base only, the 327X device accounts for 3,128 (25%) installed units. The on-order figure is 591 units, which represents the long lead times still in effect for the 3278 and possibly reflects 3279 (color graphics) orders as well.

  - The 36XX installed base of 600 units (5%) reflects their use as specialized banking terminals. The backlog of 191 36XX units again reflects lead times of 90-120 days. This backlog is also reflected for Bunker Ramo's banking systems, where lead times are 60-90 days.

  - The average number of 327X units installed in the large scale CPU user environment is 175.8 units per system. While this may appear high, a recently completed study by INPUT entitled, "Mass Storage and Other Peripheral Devices: Cost, Performance, and Future Directions," indicated that the large central site users surveyed will increase terminal usage to an average of 735 units per system in 1985, up from 390 units in 1979. The implementation of additional interactive programs was the reason for the increase.

7. LARGE SCALE USERS, SUMMARY

- IBM continues to control any significant erosion of their large scale users market, as indicated in Exhibit III-1. With the exception of the incursion by the terminal vendors (and these are low priced, low profit items), IBM has successfully contained competition while fostering customer loyalty regardless of long delivery times for new products and pricing adjustments for installed units.

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EXHIBIT III-1

LARGE SCALE USER SUMMARY

PRODUCT	TOTAL UNITS INSTALLED	IBM				PLUG COMPATIBLE VENDORS			
		INSTALLED	PERCENT OF TOTAL UNITS INSTALLED	ON ORDER	PERCENT OF TOTAL UNITS INSTALLED	INSTALLED	PERCENT OF TOTAL UNITS INSTALLED	ON ORDER	PERCENT OF TOTAL UNITS INSTALLED
CPUS	71	71	100 %	13	18%	-	-	-	-
DISKS	1,435	1,047	73	90	6	388	27	37	3%
TAPES	680	429	63	5	1	251	37	-	-
PRINTERS	148	119	80	9	6	29	20	-	-
TERMINALS	12,482	6,707	54	790	6	5,775	46	235	2

NOTE: PERCENTAGES HAVE BEEN ROUNDED ON A BASE OF 0.5±

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- Plug compatible vendors will probe the IBM large scale user base for opportunities. These opportunities will be manifest through:

  - Increased price/performance capabilities over comparable IBM products.

  - Immediate product availability.

  - The ability to quickly respond to new or enhanced IBM announcements and deliver their plug compatible products to market before IBM.

  - Systems packaging of products, including peripherals and communications oriented equipment.

- INPUT predicts that competitive pressures between each of the plug compatible vendors will increase as they attempt to move products into IBM's large scale user domain. As a result, mergers and acquisitions between plug compatible manufacturers will occur where product synergism and complementary market opportunities exist.

  - Selected BUNCH (Burroughs, Univac, NCR, CDC, and Honeywell) manufacturers are also casting covetous eyes at IBM's large user base. Both Burroughs and NCR are entering into exploratory merger discussions with Memorex.

  - Amdahl and STC are discussing product integration opportunities (short of an outright merger) now that the Amdahl-Memorex merger discussions are terminated. In any event, domestic and emerging foreign competition (with money, resources, and dedication) will keep nibbling at IBM's lucrative base.

  - Foreign manufacturers have not been idle. Siemens and Memorex have conducted preliminary merger discussions.

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- It is conceivable that Amdahl will package Fujitsu disks and tapes on Amdahl CPUs.

- Amdahl may announce shortly a 3705 compatible telecommunications control unit (TCU) from Fujitsu as a front end communications controller for its "V" series.

8. IN-HOUSE TIMESHARING USAGE AND PLANS

- In-house timesharing operations continue to show rapid growth for large mainframe users. As indicated in Exhibit III-2, 33 respondents (66%) indicated they provide this capability.

- The number of on-line users at any one time varied considerably. This variance is the result of decisions reached by the central site to support a wide spectrum of timesharing (TS) usage. Some central sites encourage TS for program development only. Others are far more liberal and encourage users to accelerate interactive programs and systems with little concern for response times. Some installations provide a dedicated CPU for TS usage.

- The average number of TS users on-line at any given period was 50, and ranged from a maximum of 400 to a minimum of 4, as indicated in Exhibit III-3.

- Respondents were requested to forecast anticipated TS usage changes in the near term. As might be expected, 33 respondents (94%) indicated an increase of TS use. Only two respondents predicted no change, as indicated in Exhibit III-4.

- In a recently completed study by INPUT entitled, "Mass Storage and Other Peripheral Devices: Cost, Performance, and Future Directions," a survey of large CPU central site users indicated similar TS findings.

  - Seventy percent of the central site respondents are currently utilizing the timesharing option (TSO) on 18.5% of the installed terminals.

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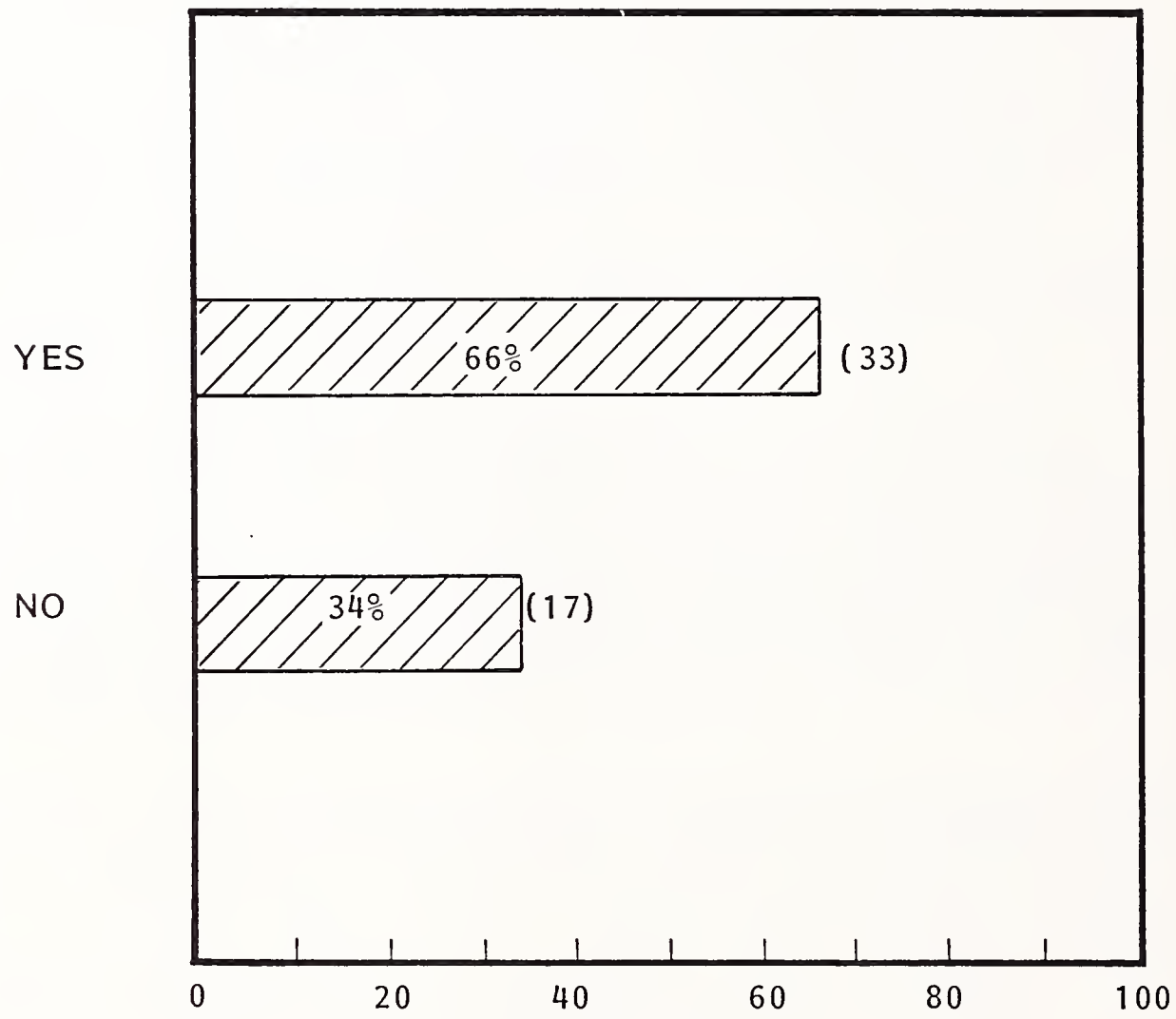
EXHIBIT III-2

LARGE SCALE USERS
PERCENT OF RESPONDENT USERS WITH IN-HOUSE TIMESHARING



NUMBER OF RESPONSES = 50

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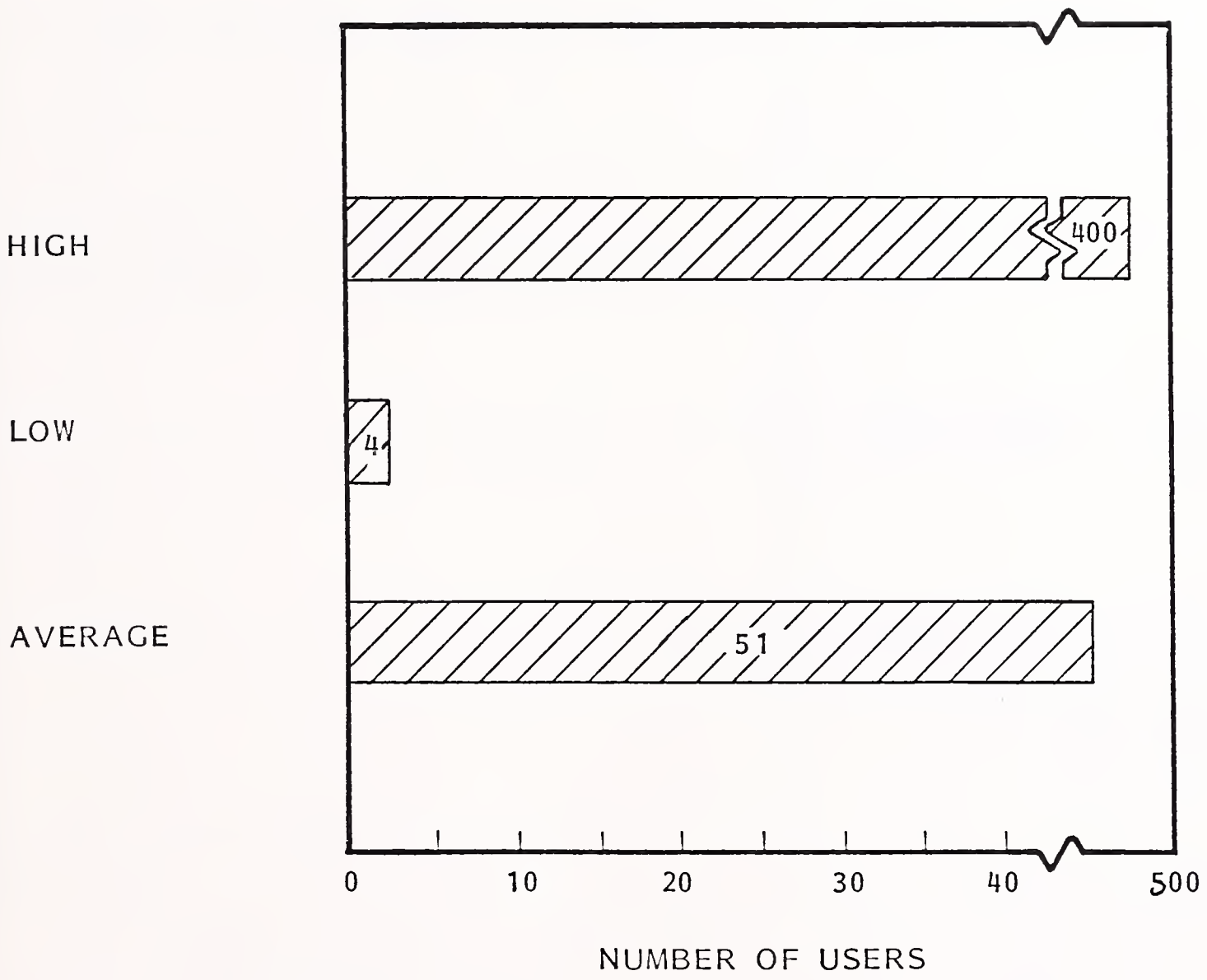
EXHIBIT III-3

LARGE SCALE USERS
AVERAGE NUMBER OF TIMESHARING USERS
ON-LINE AT ANY ONE TIME



NUMBER OF RESPONSES = 33

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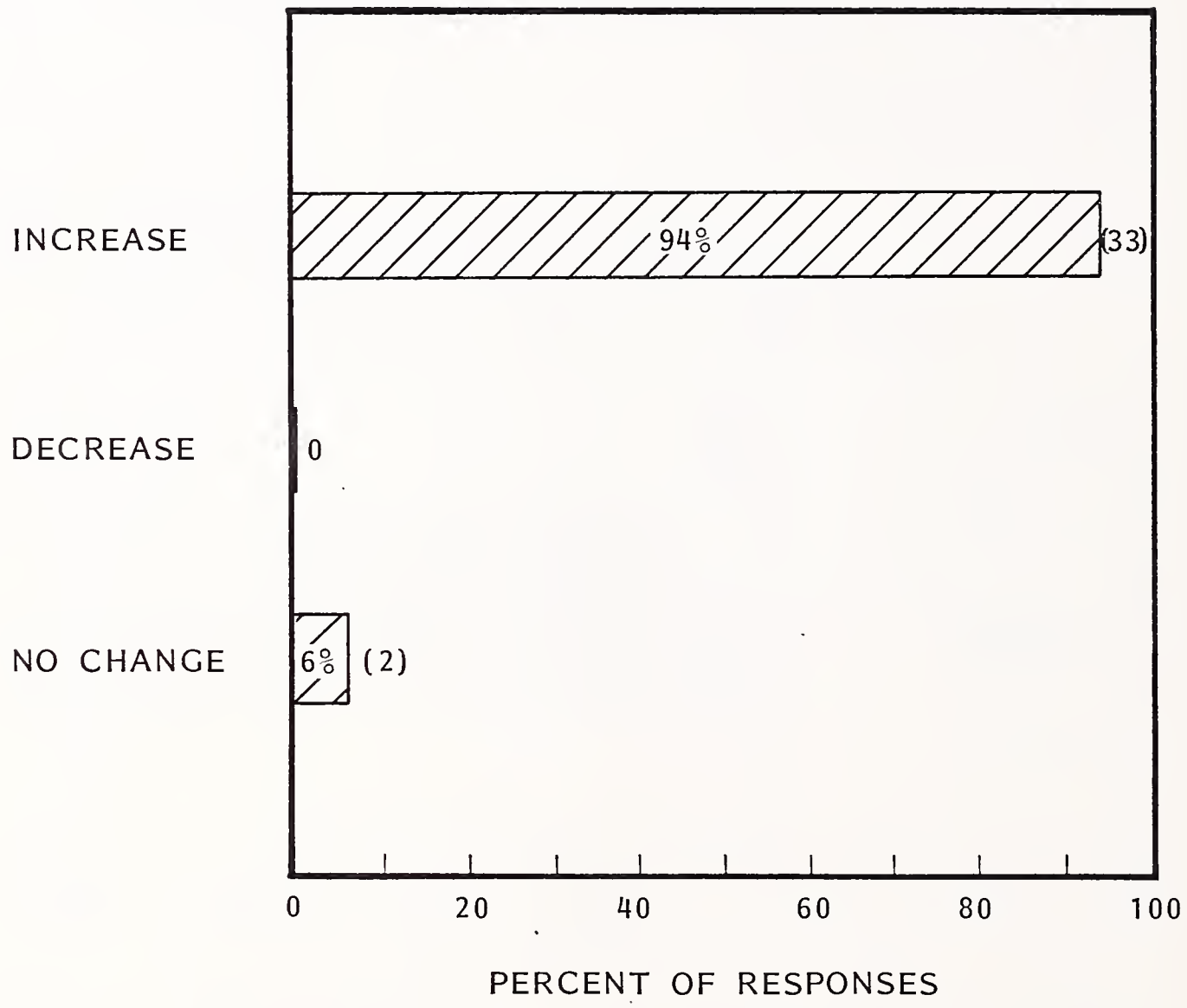
EXHIBIT III-4

LARGE SCALE USERS
PROJECTIONS OF CHANGES IN TIMESHARING UTILIZATION



NUMBER OF RESPONSES = 35

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- TSO growth is forecasted to grow at an average annual rate of 22% during 1979-1982. Terminal utilization will increase to 33.6%.

- TSO usage for program development will increase to 90% by 1982, up from 76% in 1979. These results are detailed in Exhibit III-5.

- In-house timesharing usage for large scale EDP users will show a marked increase during the coming years. Regardless of the inadequacies of IBM timesharing software (users hope for major improvements and trust IBM will come through), the overwhelming majority of new applications are interactive, thus driving TS usage while fueling terminal demand as well.

9. LARGE SCALE USERS' PURCHASE HABITS AND TRENDS

- The large scale EDP user was queried regarding purchase habits and changing trends for major product categories; i.e., CPUs, tapes, disks, terminals, and software, etc.

- The results are interesting, but the responses require additional explanation and comparison. For example, a larger response (184 answers) was obtained to the query, "Types of Equipment Purchased" and a smaller response (62 answers) to the question, "Types of Equipment Affected In Change From Purchase to Lease."

- As indicated in Exhibit III-6, the 184 responses were fairly evenly distributed for all hardware categories, particularly tapes, disks, and terminals where the percentage spread was 1% (21-22%). CPU purchases run somewhat higher. Fifty-three responses, or 29%, stated a preference to purchase mainframes. The overall averages for the four major product areas is 23% and this percentage is an agreed upon industry average when determining lease versus purchase ratios. The "other" category was 6% and software less than 1%.

- Approximately one-third of the large scale users are changing from purchase to lease as the method of acquisition, as indicated in Exhibit III-7. The largest

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EXHIBIT III-5

TIMESHARING OPTION (TSO) TRENDS

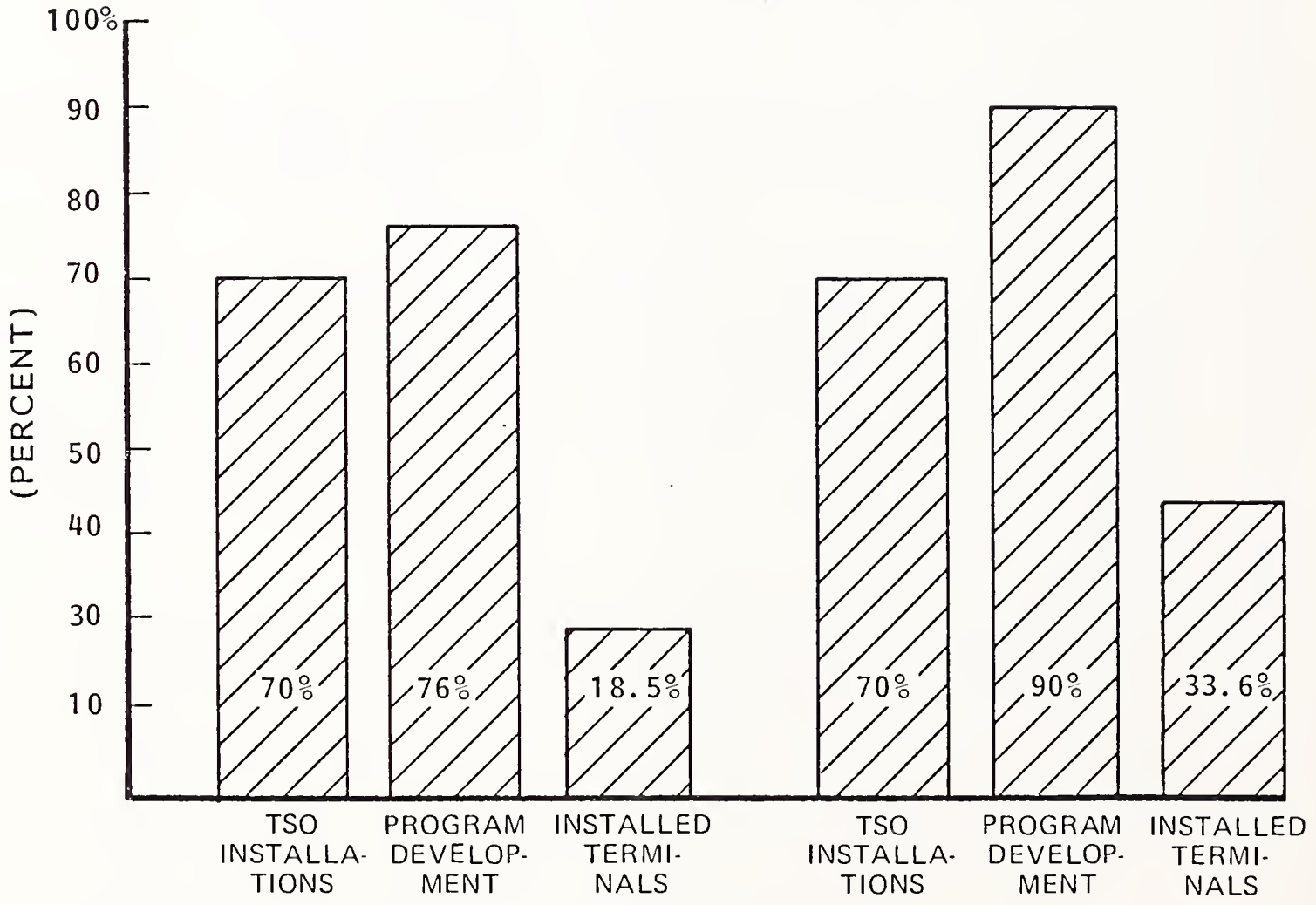

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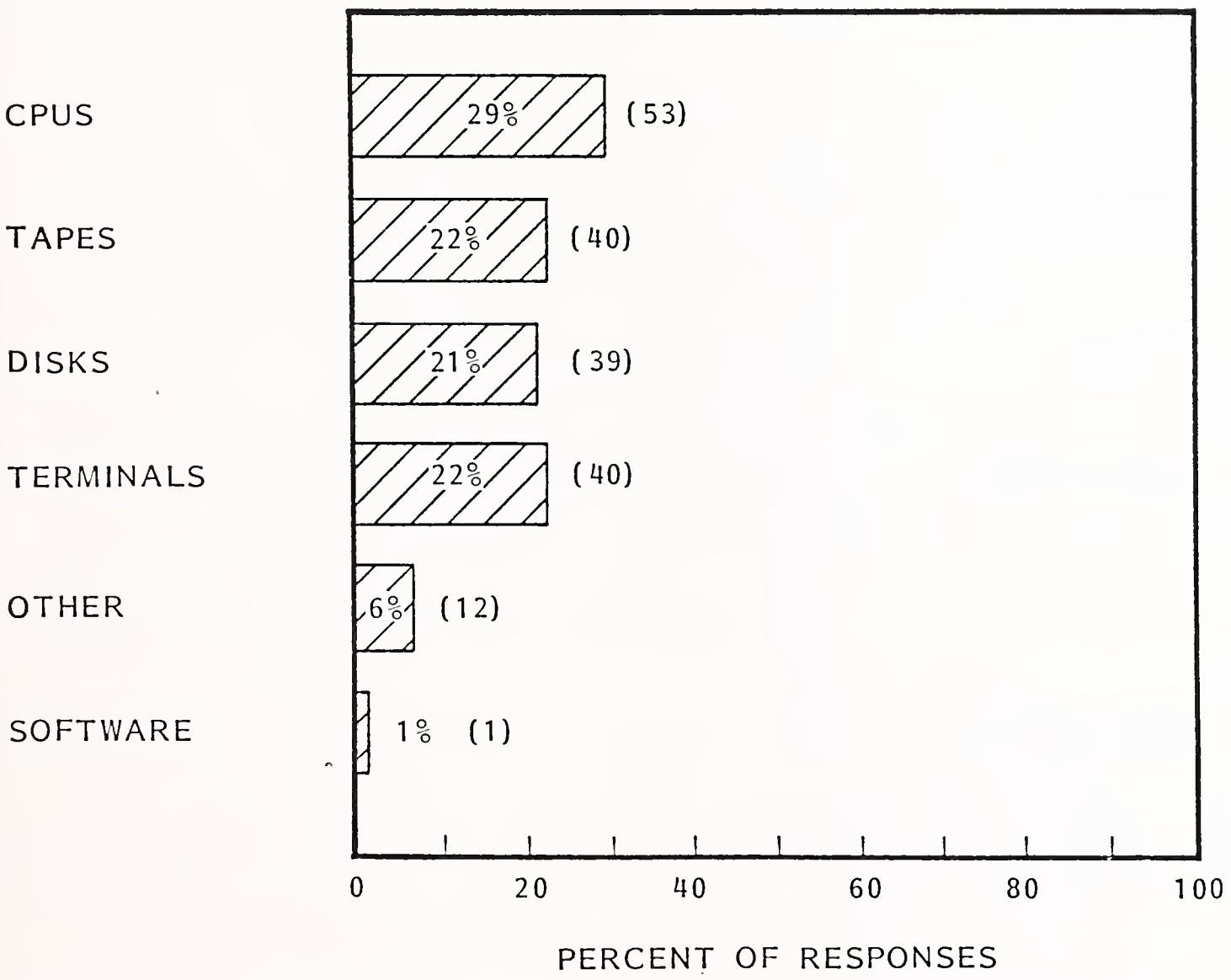
EXHIBIT III-6

LARGE SCALE USERS
TYPES OF EQUIPMENT PURCHASED BY RESPONDENT USERS



NUMBER OF RESPONSES = 184

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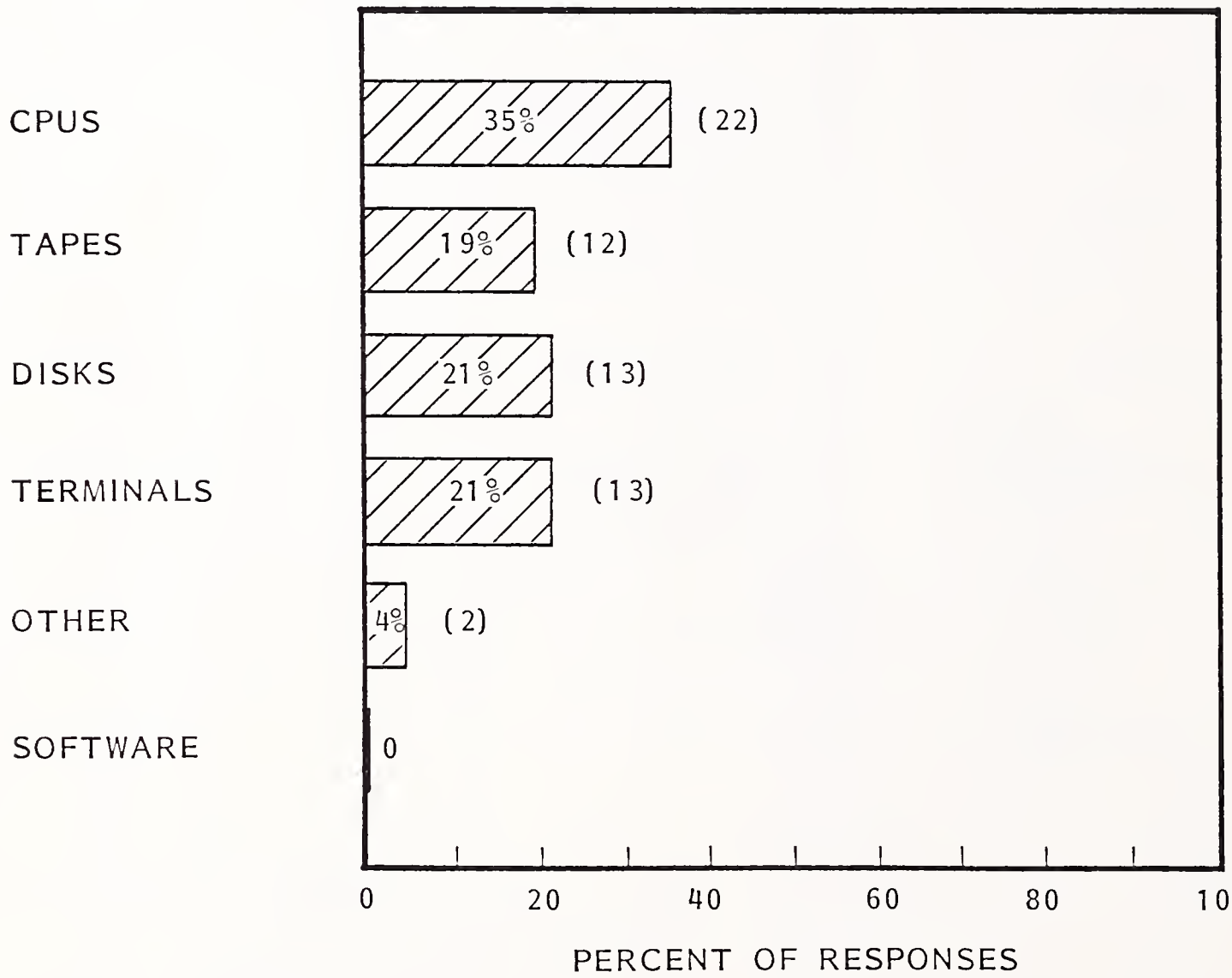
EXHIBIT III-7

LARGE SCALE USERS
TYPES OF EQUIPMENT AFFECTED
IN CHANGE FROM PURCHASE TO LEASE



NUMBER OF RESPONSES = 62

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change is in the CPU product area where 35% (22 respondents) stated a reversal in acquisition habits - favoring lease rather than purchase. Changes in buying habits for tapes, disks, and terminals ranged between 19-21% with 13 respondents exercising new lease to purchase prerogatives.

- The increased competitive atmosphere fostered by IBM and the PC vendors, because new price/performance ratios are in constant flux, has affected the decision process for purchased products. Even more important - and this refers to longer term decisions - the impending announcement of IBM's Series "H" has created a cloud of uncertainty and indecision for one-third of the users who normally purchase CPUs. Evidently they believe lease decisions provide more flexibility and will defer longer term purchase commitments until, in their belief, a period of hardware stability again returns to the marketplace.

- Large scale CPU users usually exercise a greater degree of purchase decisions than their medium or small range CPU counterparts. As detailed in Exhibit III-8, 36% of the 50 respondents affirming they normally purchase equipment, thirty (60%) prefer to lease or rent. Two had no knowledge of their organization's lease, rent, or purchase habits.

- The recent flurry of product and price announcements has created uncertainty in the user's mind regarding future equipment procurement methods. As a result, users are becoming more cautious regarding outright purchase. They now prefer more flexible base terms which provide greater contract flexibility to respond to the changing competitive environment.

- As indicated in Exhibit III-9, 18 respondents commented on shifting attitudes from purchase to lease. Ten (56%) answered that they perceived a change from purchase to lease within their organization's computer equipment buying habits. Seven, (39%) indicated no change, while one did not know of any change.

- The users' changing attitudes from purchase to lease confirms the financial impact suffered by IBM and the PC vendors alike. A comparison of the

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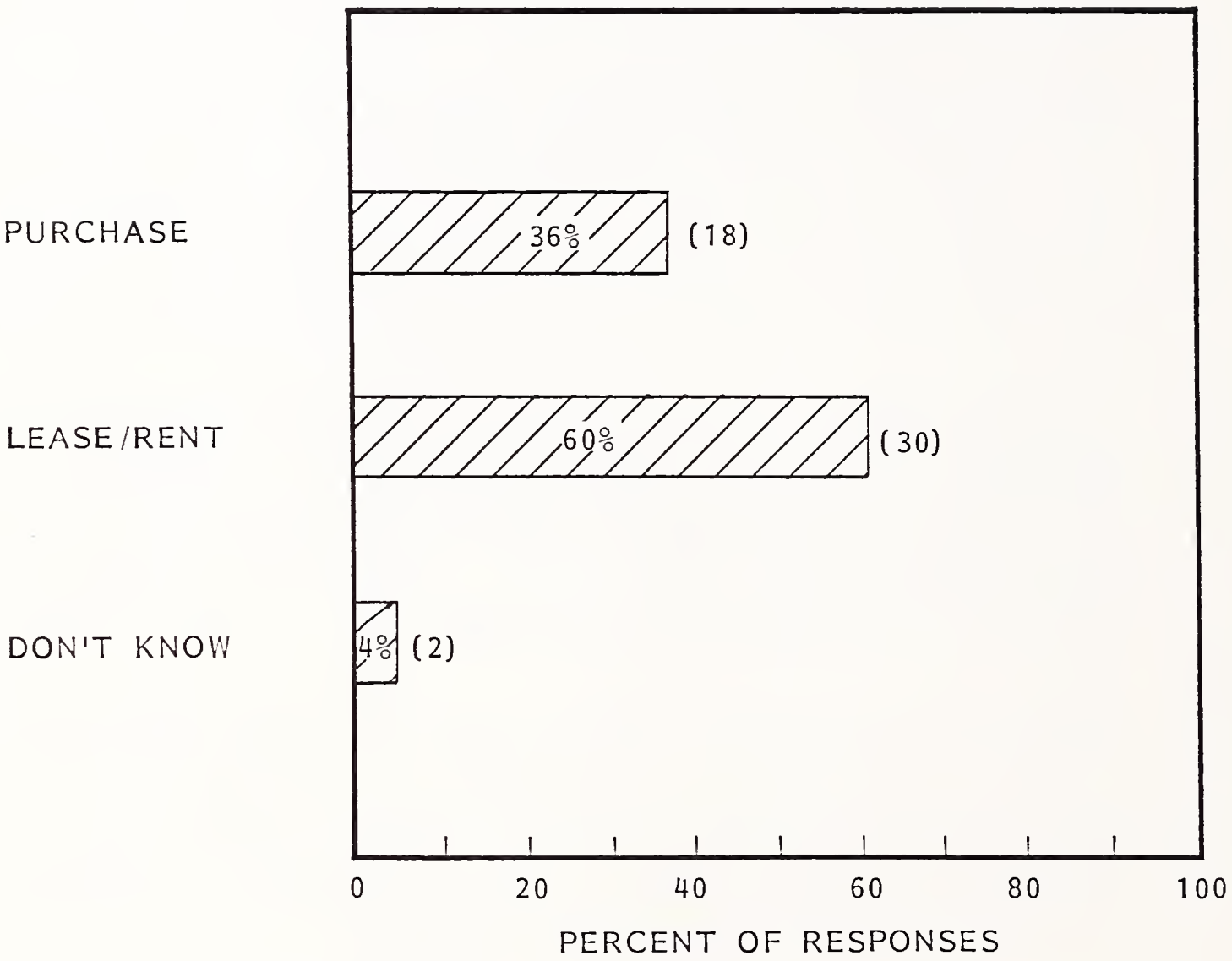
EXHIBIT III-8

LARGE SCALE USERS
PRESENT METHOD
OF EQUIPMENT ACQUISITION



NUMBER OF RESPONSES = 50

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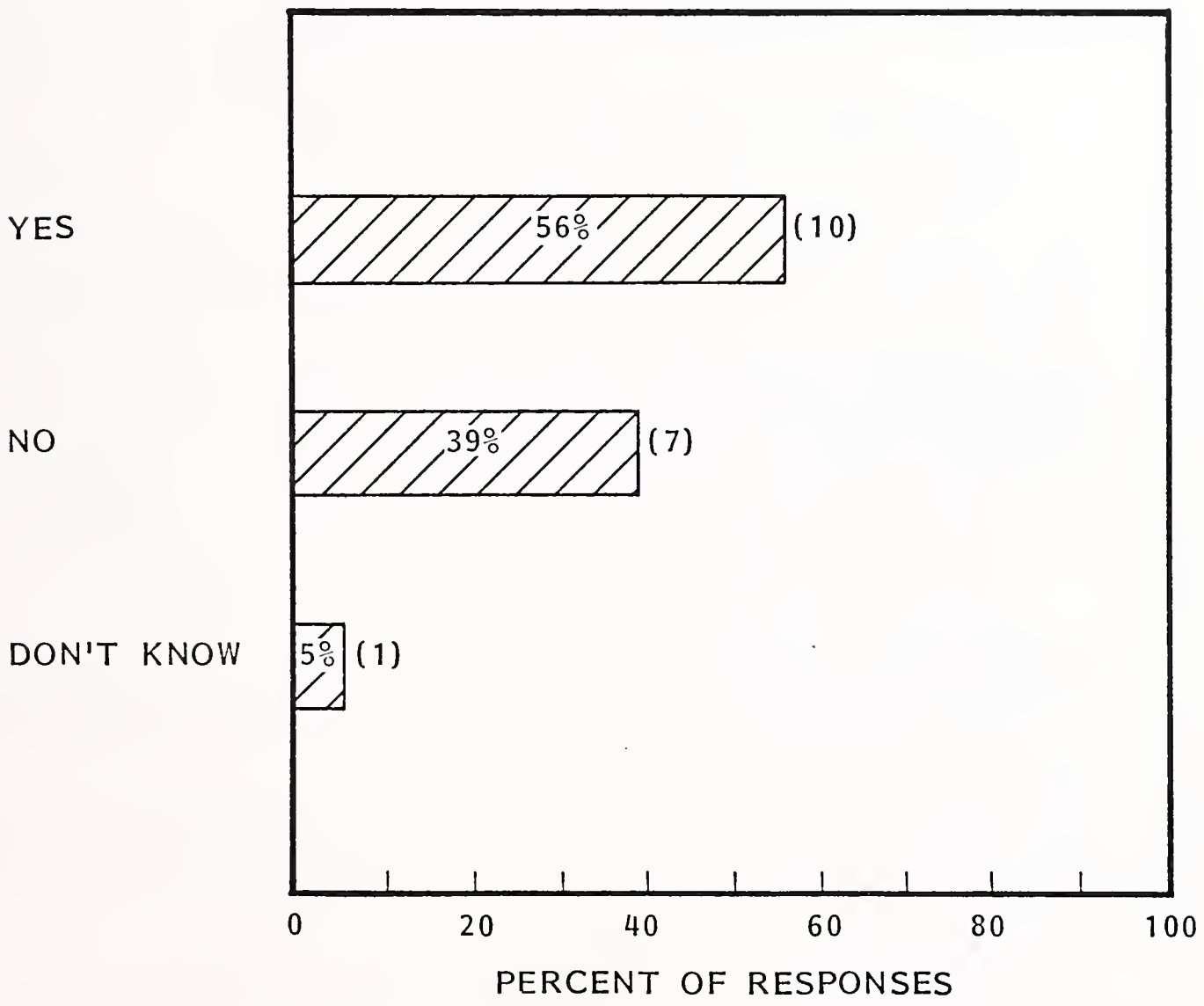
EXHIBIT III-9

LARGE SCALE USERS
PERCEIVED CHANGE OF PURCHASE TO LEASE AS A
METHOD OF EQUIPMENT ACQUISITION



NUMBER OF RESPONES = 18

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respondents' attitudes between Exhibits III-8 and III-9 suggests that where 36% previously purchased equipment, 56% are now perceiving changes in their buying practices - a net reduction of 20% from purchase to lease.

10. PLUG COMPATIBLE VENDOR PROPOSAL ANALYSIS

- Respondents were requested to answer a series of questions relating to mainframe and peripheral offerings by the plug compatible vendor community. The first question addressed the issue of proposals and the means by which these proposals were obtained.

- As depicted in Exhibit III-10, 50 respondents replied to the questions regarding PC vendor proposal solicitation. Thirty-eight (76%) indicated they actively solicit equipment proposals from the PC vendor community. Twelve of the respondents answered the negative: they did not actively solicit proposals.

  - Eight believed it was up to the vendor to be aware of the potential customers' needs through active territory canvassing.

  - Four indicated they were pro IBM and would not consider PC vendors.

- The second part of the proposal question dealt with unsolicited proposals from PC vendors. Forty-six respondents (92%) welcomed unsolicited proposals.

  - The same four respondents who would not actively solicit proposals indicated they would not welcome unsolicited PC vendor proposals.

- Eighty-six percent of the respondents (43) indicated they had reached a positive bottom line decision by acquiring plug compatible products. Only 14%, which again includes the four who appear to be pro IBM, stated they had not acquired PC equipment. The reason for not acquiring products was concern for service quality.

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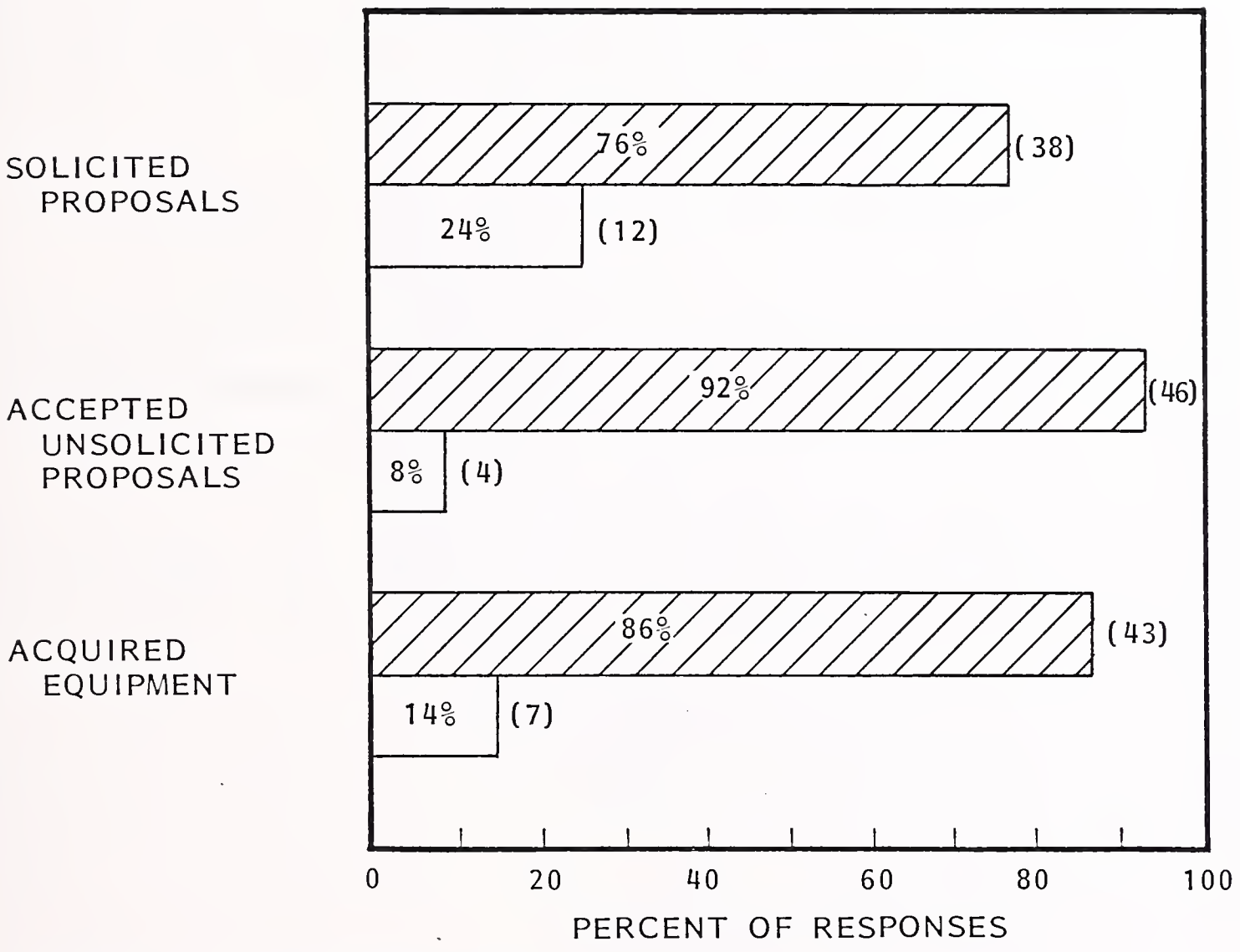
EXHIBIT III-10

LARGE SCALE USERS
ACTIONS REGARDING ACQUISITION OF PC/PCM EQUIPMENT



NUMBER OF RESPONSES = 50

YES

NO

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- According to INPUT's sample, over 75% of the large scale user community is receptive to unsolicited proposals from PC vendors.

- Anticipated price/performance improvement levels are expected by the users. Exhibit III-11 details the improvement expectations by the 50 respondents. Forty-eight percent (24) answered that price/performance savings ranging between 20-30% are required. Thirty-two percent (16) answered that no specific level was required. Seven respondents (14%) answered they did not know. The remaining 6% of the answers fell into "less than 20% savings category," and "not buy in any event."

- Large scale EDP users fall into three decision making categories:

  - Only 4% said they would not buy. This indicates the large scale user is open-minded and objective and supports the previous high percentage level response for solicited and unsolicited proposals.

  - Forty-eight percent of the respondents expect price/performance savings ranging from 11% to more than 30%, with 28% falling into the 21% to more than 30% savings range.

  - Thirty-two percent indicated there was no specific level of savings required. However, embedded in this answer are other decision making considerations. These include service, performance, product migration capabilities, contract flexibility, and vendor image. This group represents a "show me" attitude and requires a dedicated and sometimes costly sales effort. Price/performance considerations will surface once the above objections are minimized.

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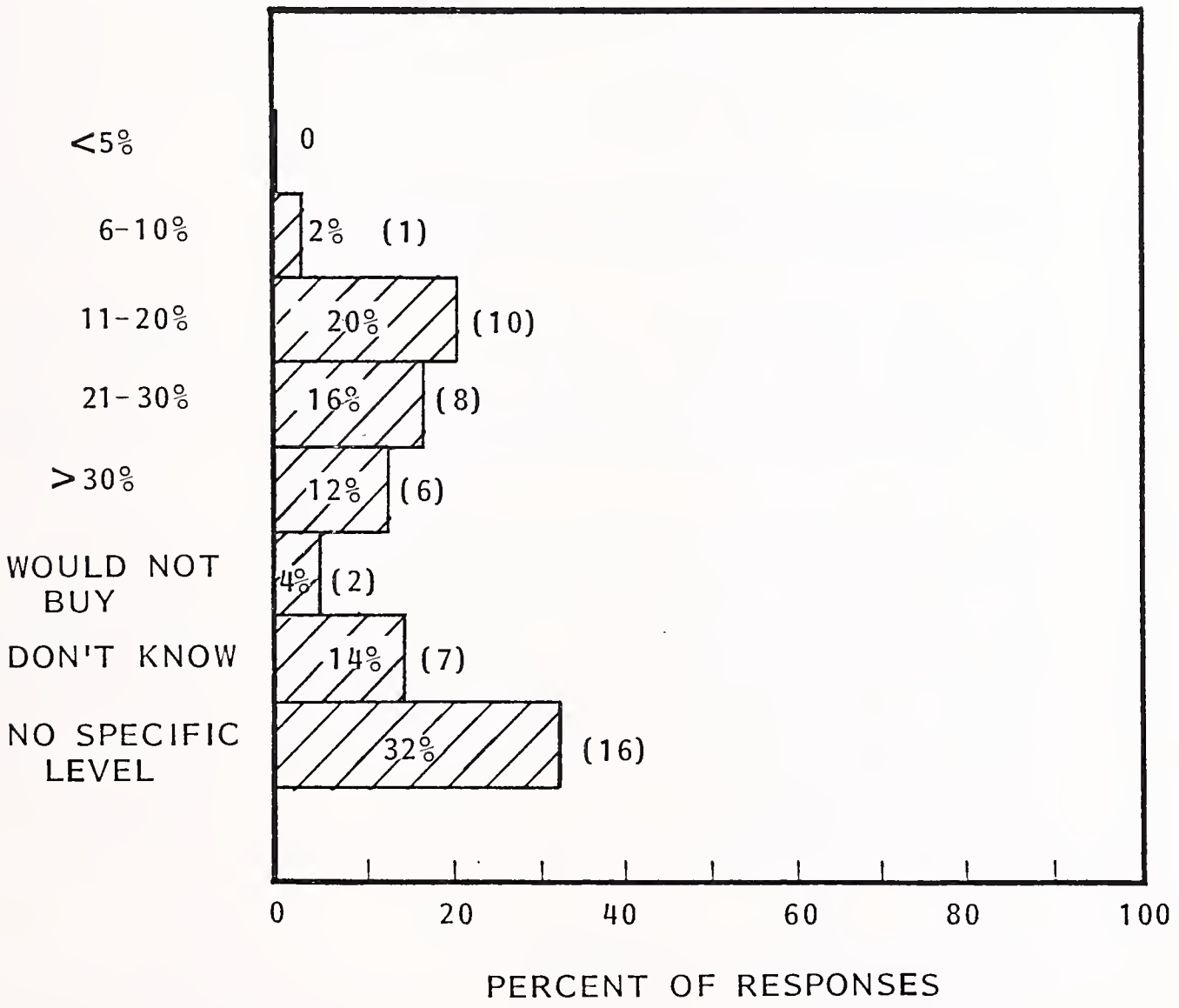
EXHIBIT III-11

LARGE SCALE USERS
PRICE SAVINGS LEVELS REQUIRED
TO PURCHASE PC/PCM EQUIPMENT



NUMBER OF RESPONES = 50

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11. TECHNOLOGY ANALYSIS

- Exhibit III-12 addresses the user's willingness to accept a new technology from the PC vendor prior to its announcement by IBM. Seventy-six percent, or 37 users, answered the question positively. Ten respondents (20%) said they would not accept a new product technology unless first announced by IBM.

- Large scale users are accustomed to trying out new ideas. Their positive answer to the technology question supports other affirmative answers regarding PC vendor products.

12. TOTAL PRODUCT LINE OFFERINGS

- Users were requested to comment on the importance of PC vendor product lines and whether vendors should specialize in: peripherals only, mainframe only, mainframe and peripherals, or all of the above, plus software.

- More than 60% of the respondents said it was not important for vendors to provide more than one product. As indicated in Exhibit III-13, the answers were closely grouped for all question categories - with one exception. The question regarding vendors supplying peripherals, mainframes, and software was answered approximately 9% more positively compared to the other three categories, indicating a slight trend toward an appreciation of systems integration.

- During the interviews, respondents stated they personally saw no problems for the plug compatible vendors to confine their product development to those areas where they have previous expertise. In this way, they believed the PC vendor had a better opportunity on continuing lines rather than going into new product ventures. In other words, they should continue doing what they do well by concentrating on products and markets that are familiar. The majority of large scale users do not expect the PC vendors to be all things to all people.

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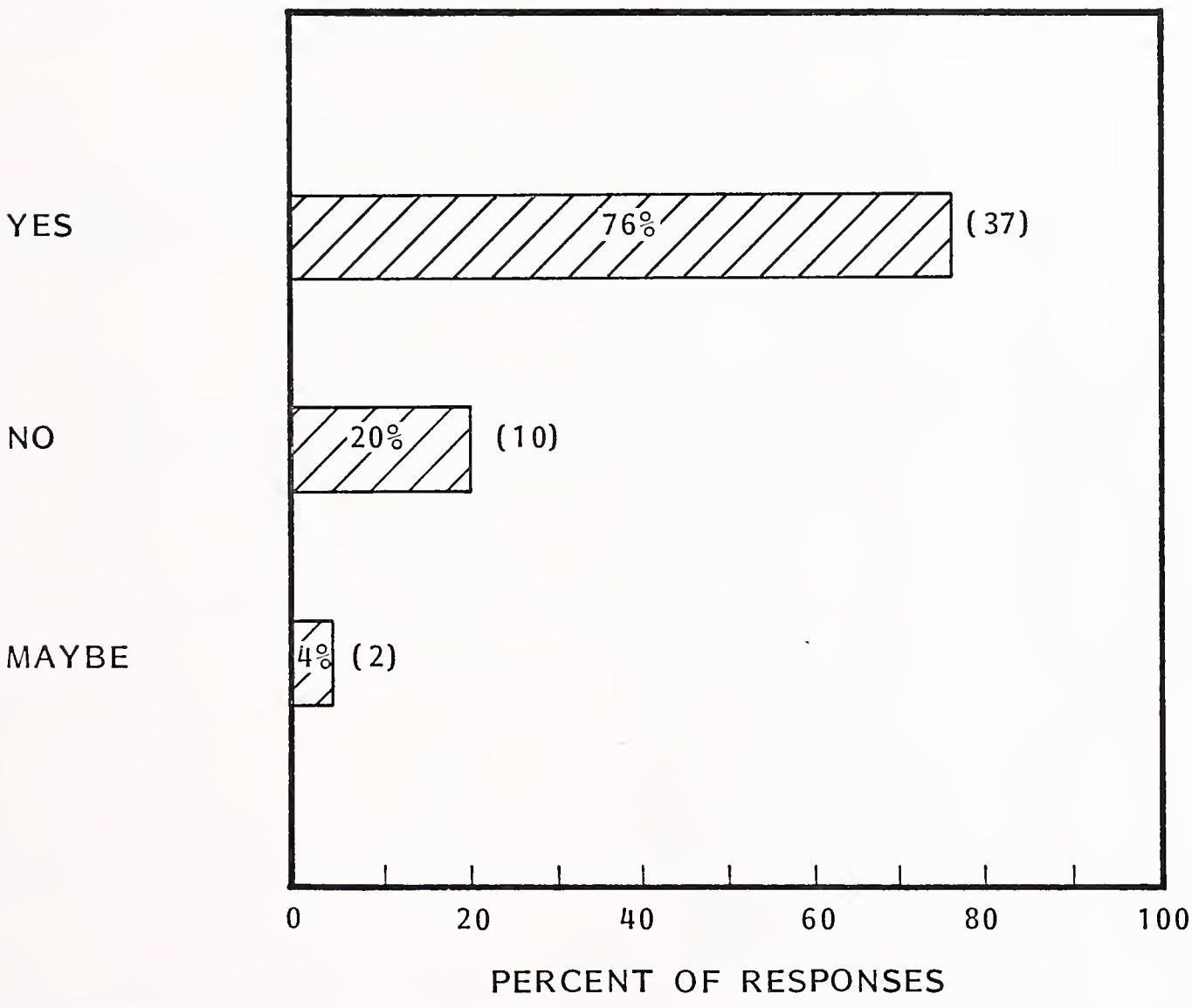
EXHIBIT III-12

LARGE SCALE USERS
RESPONDENT USERS' WILLINGNESS TO ACCEPT NEW
NON-IBM TECHNOLOGY PRODUCTS



NUMBER OF RESPONSES = 49

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EXHIBIT III-13

LARGE SCALE USERS

RESPONDENT USERS' PERCEPTION OF PC/PCM VENDORS' OFFERINGS OF EXPANDED PRODUCT LINES

PLUG COMPATIBLE VENDOR OFFER	IMPORTANT		SOMEWHAT IMPORTANT		NOT IMPORTANT		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
PERIPHERALS ONLY	7	15%	6	13%	33	72%	46
MAINFRAME ONLY	5	11%	6	13%	34	76%	45
MAINFRAME/ PERIPHERALS	7	15%	9	20%	30	65%	46
ALL ABOVE PLUS SOFTWARE	10	22%	8	17%	28	61%	46

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- The respondents who favored total systems capabilities from PC vendors are those who have had good relationships, particularly where products were not oversold and maintenance service was equal to or better than IBMs. This group also believed that the future direction for the PC manufacturers requires systems synergism in order to successfully compete against IBM. They were most vocal on this issue.

13. THE JAPANESE ALTERNATIVE

- Respondents were quizzed about the Japanese computer/peripheral industry as a plug compatible alternative to U.S. manufacturers. Overall, 48 respondents answered this question. The breakdown of answers are indicated in Exhibit III-14.

  - Thirty-nine, or 81%, answered that the Japanese are indeed possible contenders.

  - Six, or 13%, answered "no."

  - Three did not know.

- To date, Japanese manufacturers have made a good accounting of themselves in selected product, market, and technology areas. In the semiconductor manufacturing arena, Nippon Electric Co. (NEC), Fujitsu, and Hitachi have plants in operation or are building plants in the U.S. for the 16K RAM (Random Access Memory) computer/peripheral chip. In addition, Toshiba is on the verge of locating a suitable U.S. facility for semiconductor manufacturing. Market acceptance is good. Retention rates for Japanese 16K RAMs are one-half to one-third those of their U.S. counterparts.

- As for finished computer/peripheral products, Fujitsu has been selling disk and tape products to Memorex for years. Memorex markets these products under its own name. In the past, Hitachi was providing its M series computer to Itel to compete against the IBM 3033. The M series achieved an enviable

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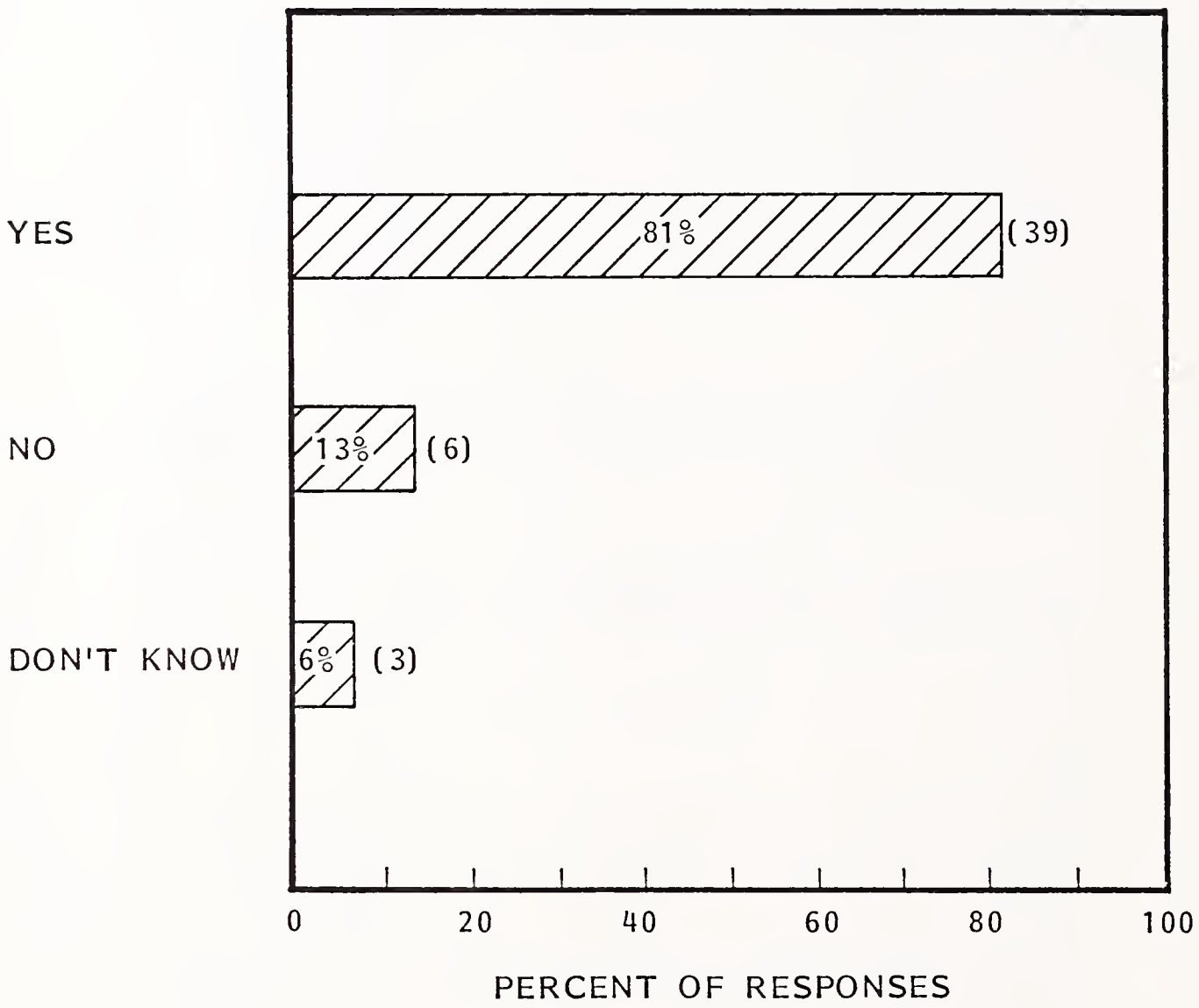
EXHIBIT III-14

LARGE SCALE USERS
RESPONDENT USERS' PERCEPTION OF JAPANESE
COMPUTER/PERIPHERAL INDUSTRY AS A POSSIBLE
CONTENDER IN THE U.S. MARKETPLACE



NUMBER OF RESPONSES = 48

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price/performance ratio with excellent MTBF (mean time between failures) standards.

- A number of respondents are aware of the current relationship between U.S. PC vendors and the Japanese manufacturers. They see an advantage for themselves as well as the U.S. PC vendor to selectively incorporate Japanese technology and products into a system offering. They appear to draw the line, however, on buying a total Japanese system. Buy American was clearly expressed, including comments on the unfairness of protective Japanese import tariffs assigned to U.S. made computer products entering Japan.

14. DISK AND TAPE STORAGE TRENDS - MASS STORAGE UTILITY

- Users were requested to respond to a series of questions regarding the concept of mass storage as a utility. These questions addressed storage requirements in the following categories:

  - Mostly archival.
  - Intermediate element of a storage hierarchy with disk the highest and tape the lowest.
  - Fundamental element of a totally on-line storage system.
  - Other.

  The answers to the above questions are compiled in Exhibit III-15.

- Large-scale users have fostered the growth of on-line interactive systems. Their assessment of the concept of a mass storage utility as a fundamental element of a totally on-line storage system reflects, to a great degree, mass storage systems (MSS) evolution and IBM conditioning.

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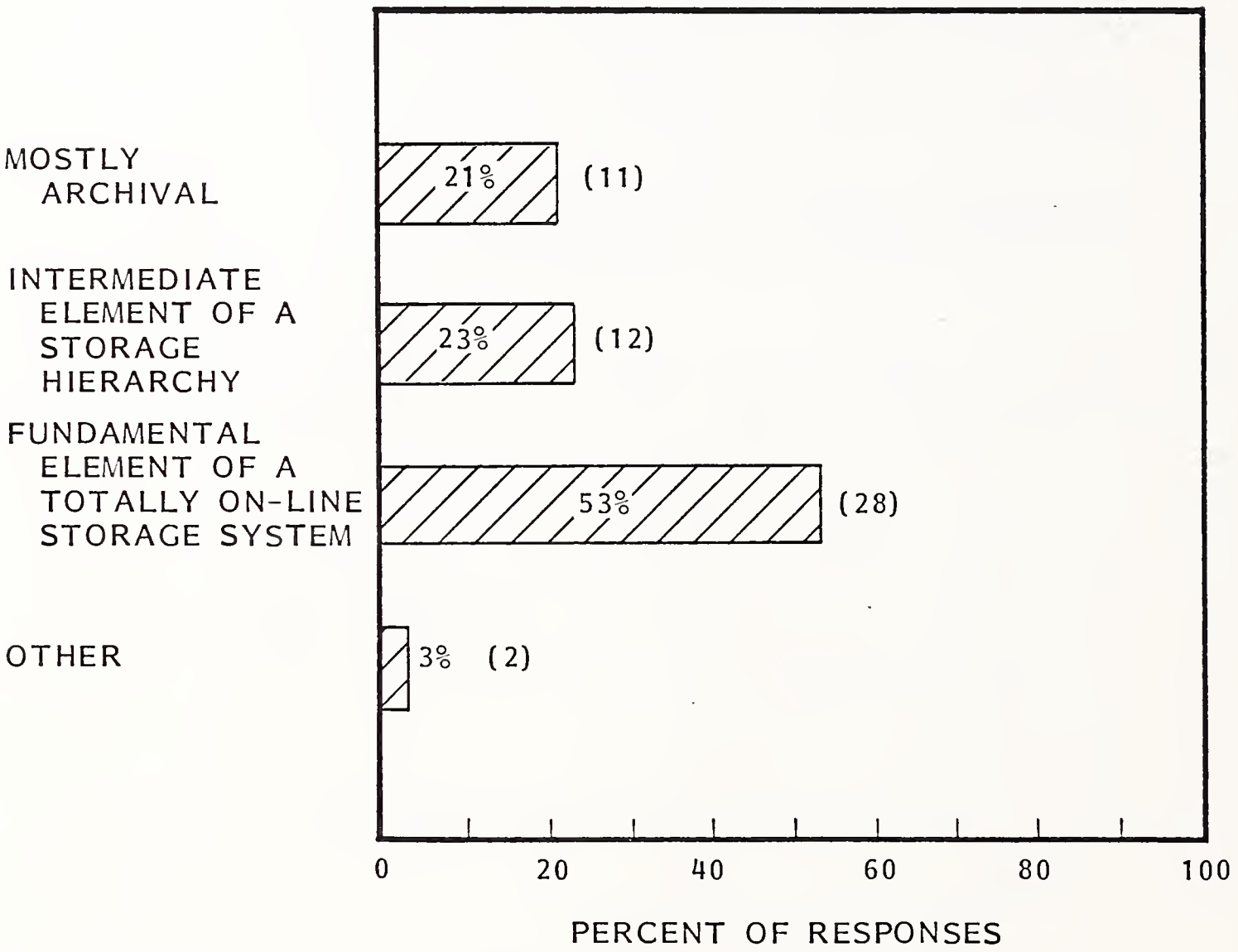
EXHIBIT III-15

LARGE SCALE USERS
RESPONDENT USERS' CONCEPT OF THE MASS STORAGE UTILITY IN THE USERS' OPERATION



NUMBER OF RESPONSES = 53

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- No respondents had an IBM 3850 Mass Storage System (MSS) installed. One respondent did indicate he thought IBM's MSS approach was a "Rube Goldberg" situation. However, in a recent study conducted by INPUT, where large centralized CPU users had such devices on site, the majority of the respondents indicated a lack of interest in the 3850 because:

  - Need for more flexible on-line, interactive storage requirements.

  - Need for faster transfer rates than provided by MSS devices.

  - Access times are too slow compared to revolving head devices.

  - Same random access of data.

- For those respondents who installed the 3850, they confirmed their decisions by declaring economic justification which encompassed:

  - Operator savings by eliminating mounting times for one-half inch magnetic tapes.

  - Providing users with increased data storage capacities for selected interactive applications where response times are not critical.

  - Providing a hierarchy of Direct Access Storage Device (DASD) storage capabilities to be used as applications or systems dictate.

  - Selective usage for archival storage.

- All the above users of 3850 units offered words of caution regarding justification and implementation of the devices. They implied manufacturers have a tendency to oversell price advantages and downplay software and systems integration problems.

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15. MAGNETIC TAPE STORAGE AND TRENDS

- Between 40-44 respondents answered the series of questions regarding magnetic tapes as a storage medium. The series of questions encompassed:

  - Total number of tape reels in the library.

  - Number of reels dedicated for storage.

  - Effective percent of the tape reels actually used for data.

- Exhibit III-16 summarizes the answers to the above questions. When analyzing the averages only, (3,995 divided by 10,152) 39% of the reels are used for storage. Probably a more sobering point is the very low percent of the reel that is actually recorded for data - only 31%.

- Regardless of the forecasts predicting the demise of magnetic tape systems, continuing technological improvements, low cost of storage, and selected applications ideally suited for tapes tend to keep the tape market alive and well.

- In the recent study on mass storage trends, INPUT research concluded that IBM commands 60% of the installed tape drive base, with Storage Technology Corporation (STC) following with 30%. Memorex (with a Fujitsu product), and Telex account for the remaining 10%.

- The study further concluded that the number of drives installed varied between 26 to 37, with the average number of units being 31.5.

- Other meaningful information derived from the mass storage trends report included:

  - 6,250 BPI tapes are replacing lower density units at central site locations.

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EXHIBIT III-16

LARGE SCALE USERS
ANALYSIS OF RESPONDENT USERS' TAPE LIBRARIES

MAGNETIC TAPE STORAGE	HIGH	LOW	AVERAGE	TOTAL NUMBER OF RE-SPONSES
TOTAL TAPE REELS IN LIBRARY	55,000	20,000	10,152	48
TAPE REELS FOR STORAGE	18,500	0	3,995	44
PERCENTAGE OF TAPE REELS UTIL-IZED FOR DATA	90%	3%	31%	40

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- From 1976 to 1979, 6,250 BPI tape sales grew an average of 16% per year. Future growth for the period 1980-1983 is forecast to average 17% per year.

- Tape drive usage varied considerably between central site installations. Generally, tape drive applications (usage) categories ranged from:

  - Serial batch: 10-90%.

  - Disk backup: 5-33%.

  - Transaction backup: 5-33%.

16. DISK AND TAPE STORAGE COMBINATIONS

- Users were asked to forecast changes in the mix between tape and disk storage from what it is today, compared to 1984. As detailed in Exhibit III-17, a range of 30-36 respondents indicated that:

  - A net increase of 20% was forecast for disk capacity while a corresponding decrease of 20% was forecast for tape storage capacities.

- The results from this survey differ substantially from other surveys recently conducted by INPUT. The most important difference is that the earlier surveys indicated that tape utilization would remain stable, and that rather than new tape applications, higher density drives would replace currently installed 556/1,200 BPI devices.

- Respondents were further requested to estimate the effective percent of disk storage actually used for the storage of data. Forty-four respondents stated that 69% of the disk was actually used for data storage, as compiled in Exhibit III-18. Disk utilization is significantly higher than that of magnetic tape, which averaged 31% (Exhibit III-16).

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EXHIBIT III-17

LARGE SCALE USERS
ESTIMATE OF RELATIONSHIP OF DISK AND TAPE AS
A PERCENTAGE OF TOTAL STORAGE FOR 1980 AND 1984

STORAGE MEDIUM	1980 TOTAL STORAGE				1984 TOTAL STORAGE			
	HIGH (%)	LOW (%)	AVER-AGE (%)	TOTAL NUMBER OF RE-SPONSES	HIGH (%)	LOW (%)	AVER-AGE (%)	TOTAL NUMBER OF RE-SPONSES
TAPE STORAGE	98%	2%	61%	36	90%	-	41%	30
DISK STORAGE	98	2	39	36	100	10	59	30

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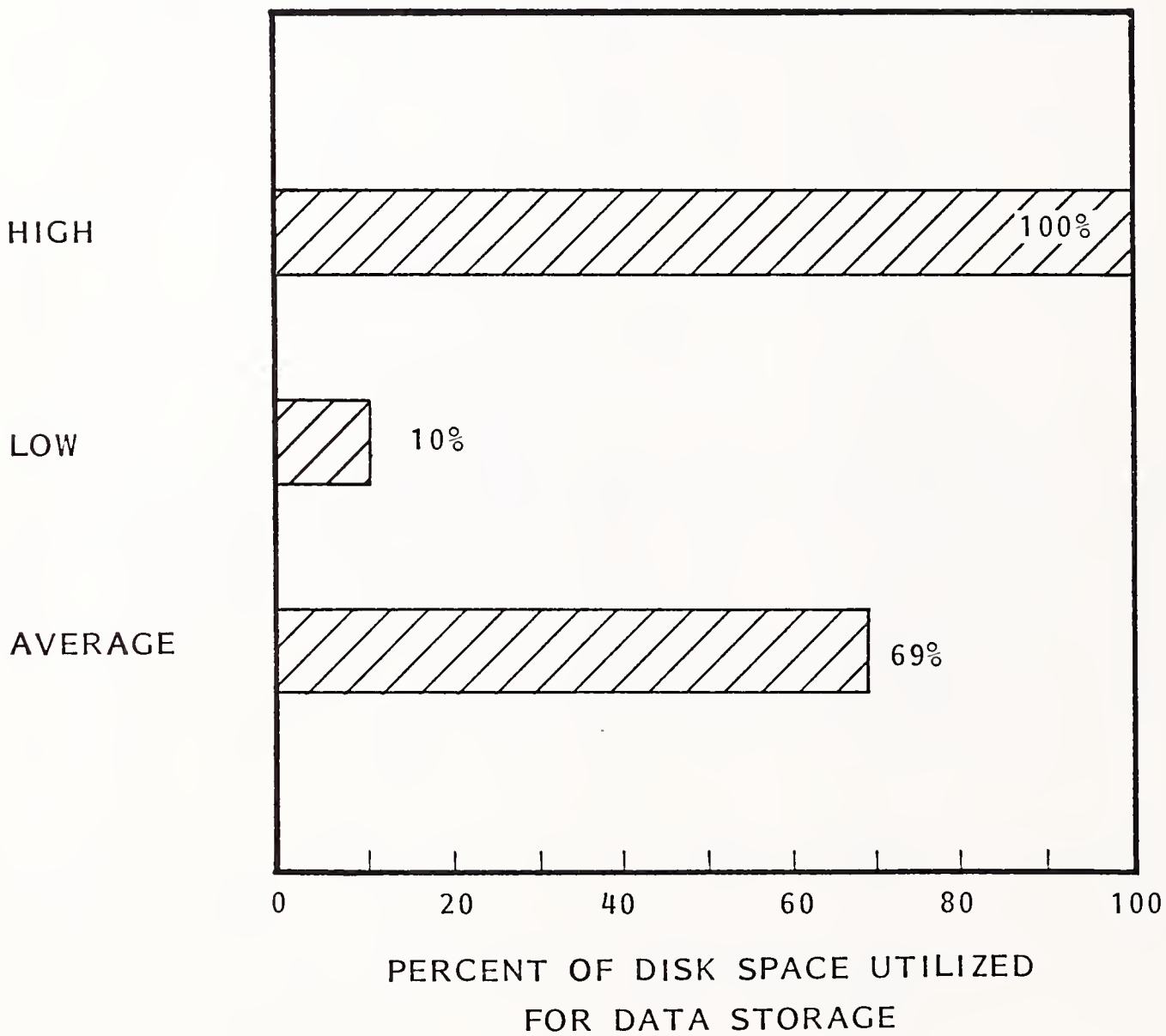
EXHIBIT III-18

LARGE SCALE USERS

ESTIMATE OF ACTUAL DISK

SPACE AVAILABLE THAT IS UTILIZED FOR

DATA STORAGE



NUMBER OF RESPONSES = 44

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17. ON-LINE STORAGE TRENDS

- Respondents anticipate large growth rates for DASD (Data Access Storage Devices) requirements. These growth rates are predicated upon:

  - New on-line applications.

  - Increased TSO usage.

  - Installation of IBM 3370 type devices.

- Between 42-45 respondents projected on-line storage increases over the next four years. Forty-five respondents stated their on-line storage will have increased 61% by year end 1980. Forty-two respondents forecast an additional growth of 215% by year end 1984, as shown in Exhibit III-19. The three year period between year end 1981 and 1984 translates to an average annual growth rate of 72% per year.

- Respondents were requested to forecast the reasons for future on-line storage growth. The results are summarized as follows:

Reason	Number of Answers	Percent
- New applications	40	53%
- TSO file increases	12	16
- Other	23	31
Total Answers	75	100%

- The forecasted growth rate of 72% appears high, based upon other studies conducted by INPUT. The recently completed study on "Mass Storage Trends,"

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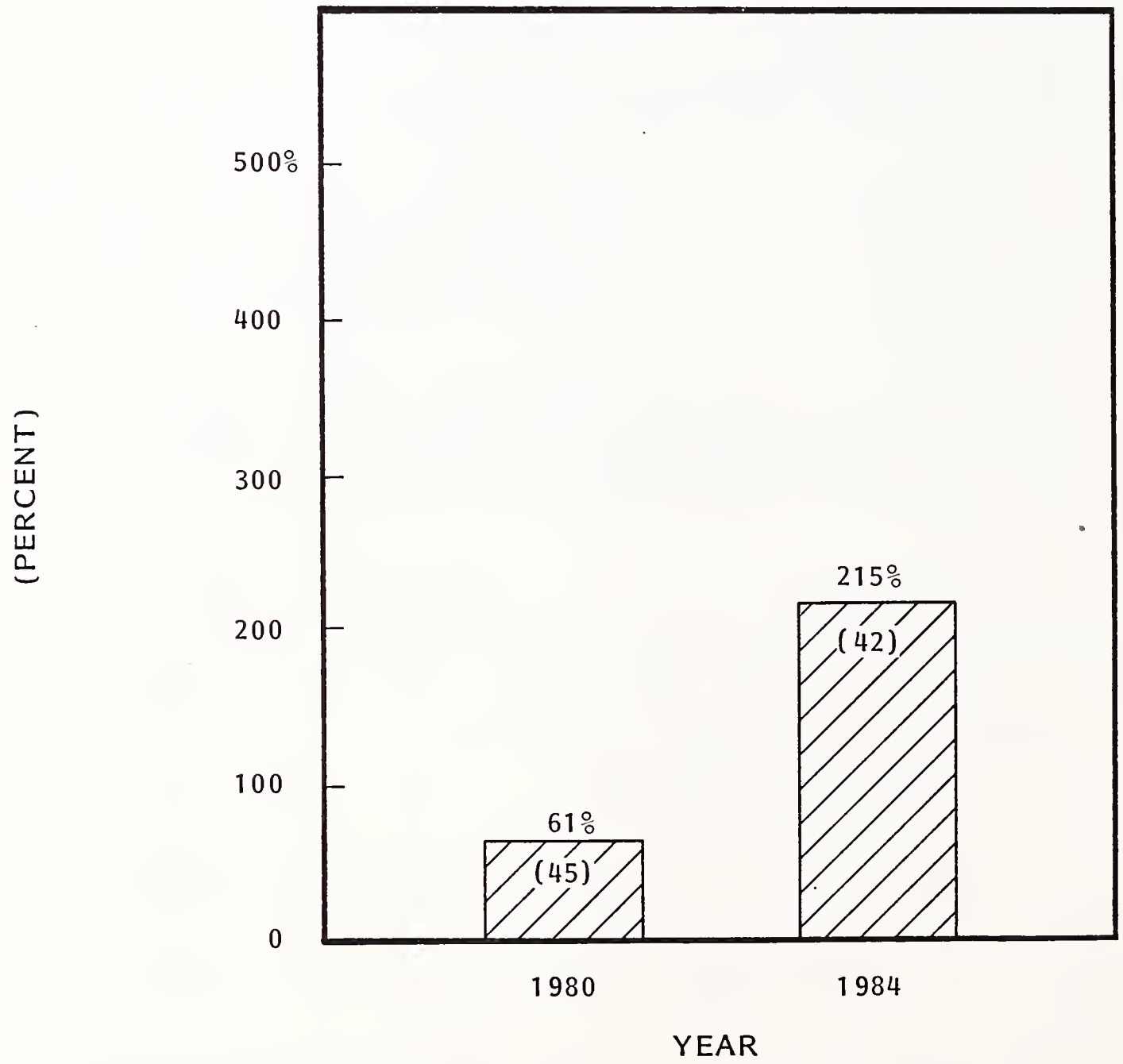
EXHIBIT III-19

LARGE SCALE USERS
PROJECTED AVERAGE INCREASE OF ON-LINE
STORAGE FOR YEAR END 1980 AND 1984



( ) = NUMBER OF RESPONSES

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indicated that DASD vendors predicated the 1980-1984 market growth rates to range between 33-40%, up from 23-33% in the 1976-1979 period. The user forecast, in this study, paralleled the vendors projections. Still other mass storage studies conducted by INPUT indicated that disk storage growth is likely to exceed 45% per year over the next five years.

- In any event, future disk growth rates are expected to increase over past periods but will not exceed 50% per year during the 1980-1985 timeframe.

18. DISK FILE DATA SETS

- Respondents were asked to comment on anticipated changes in disk file data sets. The purpose of the question was to determine whether data sets would increase or decrease and the reasons for the change.

- Twenty-seven respondents answered the question about increasing the number of disk file data sets. Eight (30%) indicated an increase is planned. Nineteen, or 70%, stated there would be no increase in the current number, as shown in Exhibit III-20. Reasons for increasing the data sets were in the form of free response answers. A sampling of these answers concluded:

  - New systems would increase the number.
  - New files necessitate increases.
  - Natural growth added sets.
  - Networking systems would expand the needs.
  - Data base developments add requirements.

- For the majority who answered the question indicating no increase, the most reoccurring response suggested that an outright directive would be enforced indicating no expansion in the number of disk file data sets.

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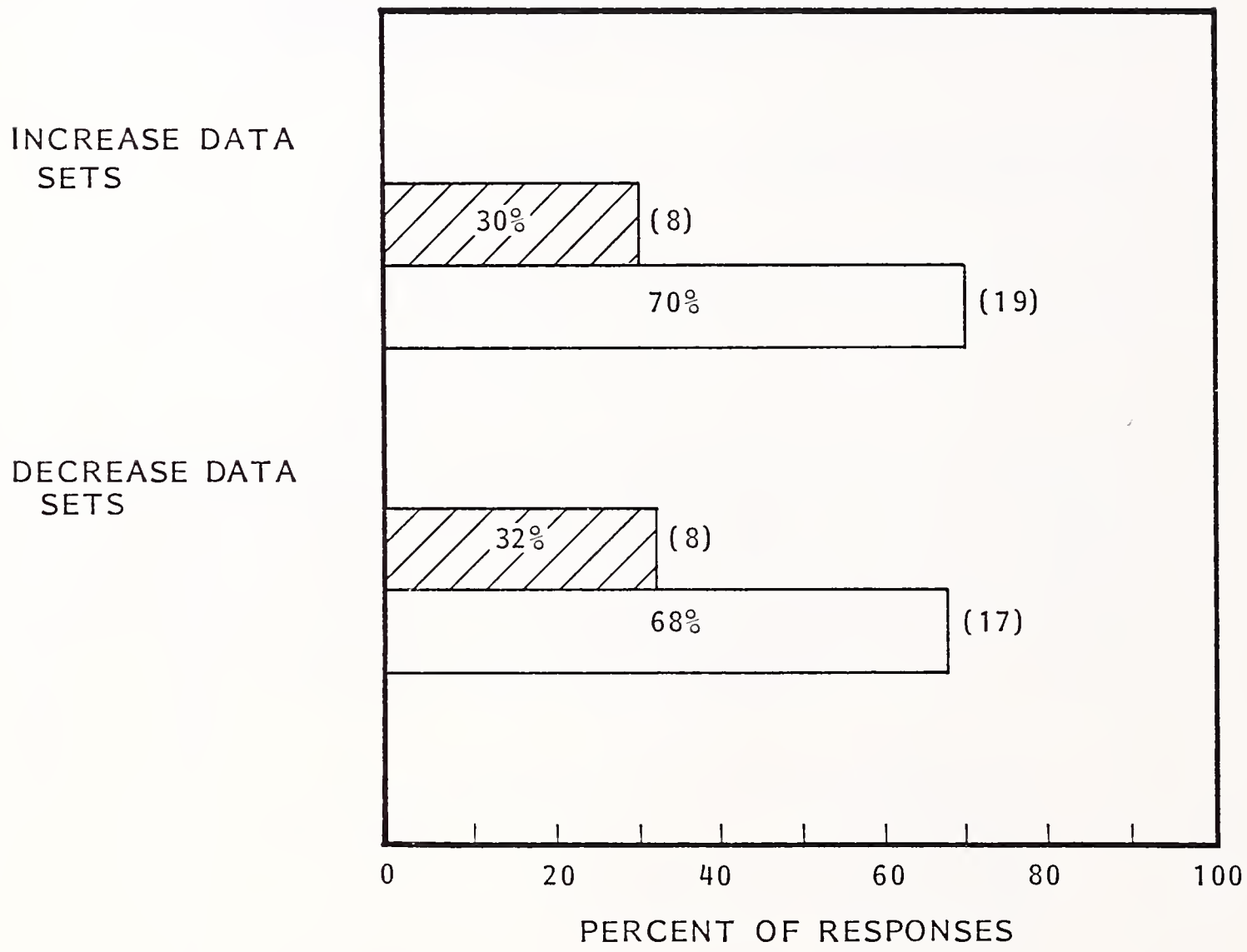
EXHIBIT III-20

LARGE SCALE USERS
RESPONDENT USERS' ACTION TO INCREASE OR DECREASE
THE NUMBER OF DISK FILE DATA SETS



( ) = NUMBER OF RESPONSES

YES
NO

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- The second part of the question dealt with plans to decrease the number of disk file data sets. Here again, the responses were fairly consistent with the previous question. Eight, or 32%, said they would decrease the number of sets. Seventeen (68%) answered to the contrary. As with the former question, free form responses were requested, detailing ways the decreases would occur. A sampling of these answers stated:

  - DBMS installed to avoid duplication of data.

  - Using more magnetic tape for archival storage.

  - Special groups had been established with the charter to review and reduce data sets.

  - Inactive files moved to tape storage.

  - Utilizing optimization techniques.

19. STORAGE MANAGEMENT TOOLS

- Respondents were asked to comment on the kinds of software or firmware tools required to assist in storage management and their preference for the supplier.

- The respondents' answers were somewhat varied, but a consistent theme emerged, namely; controllers should incorporate more intelligence to provide automatic data storage management functions.

- The users classified these "automatic" (or automated) functions to:

  - Flag inactive data sets.

  - Perform utility functions.

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- Inventory file space availability.

- Provide for file backup and file organization.

- Allocate data sets based upon frequency.

- One of the more interesting answers dealt with a single controller, including appropriate intelligence, that would be able to steer data between tape and disk storage units depending upon whether the data was archival or interactive.

- The respondents were requested to indicate their preference for a mainframe vendor to provide storage management tools. Twenty-eight respondents answered this two part question with the following results:

  . Would you expect a mainframe vendor to supply these tools?

Answer	Number of Answers	Percent
- Yes	15	52%
- No	13	45
- Don't Know	1	3
Total	29	100%

  . If yes, would you expect IBM to supply these tools?

Answer	Number of Answers	Percent
- Yes	19	70%
- No	8	30
- Don't Know	-	-
Total	27	100%

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- The conclusions drawn from these answers indicates that an average 61% of the respondents expect mainframe vendors (particularly IBM) to supply storage management tools. Approximately 38% would look elsewhere for these tools - which provides an opportunity for software houses or PC disk vendors.

20. ON-LINE BACKUP AND RECOVERY SYSTEMS

- Backup and recovery systems are an important consideration should a disaster occur and processing is terminated for any period of time. Several related questions were asked regarding the use of systems and procedures should this unfortunate situation develop. The questions addressing the following areas and their corresponding answers are detailed in Exhibit III-21.

  - Do you have a system for backup and recovery of on-line storage?

  - Have you had to use the system?

  - If so, are you satisfied with the way the system performed?

- The third part of the question related to the users satisfaction of the system when the backup/recovery operations were employed. Some of the reasons stated by the four respondents expressing dissatisfaction with the system when the backup/recovery operations were employed are:

  - Were in the process of converting from DOS to OS/MVS.

  - Slow and must recover individual data sets.

  - Not automatic enough.

  - Out of date. Recovery systems require updating.

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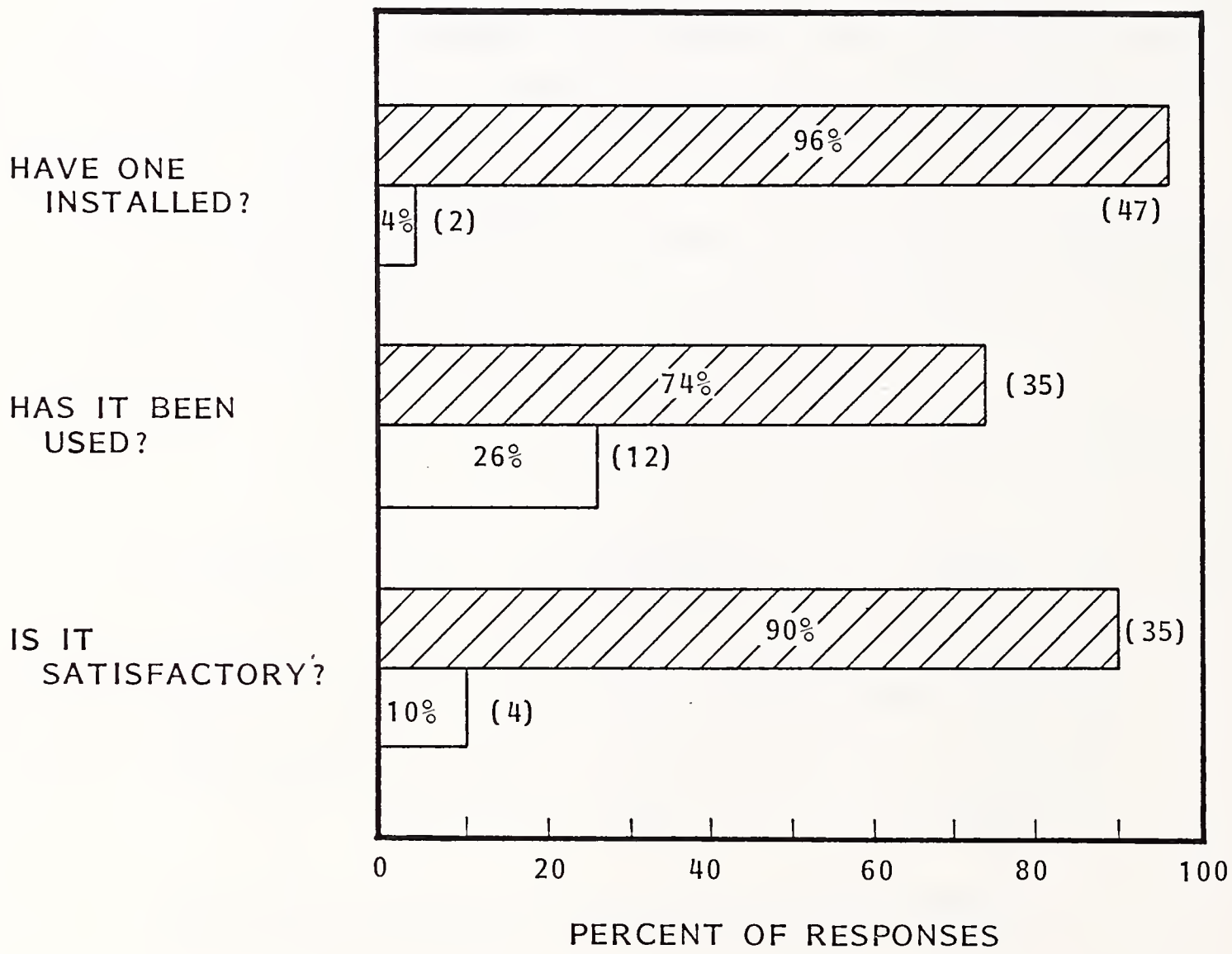
EXHIBIT III-21

LARGE SCALE USERS
STATUS OF BACKUP RECOVERY SYSTEM FOR ON-LINE STORAGE



( ) = NUMBER OF RESPONSES

YES

NO

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- In summary, backup and recovery systems are a fact of life for the large systems user. A high percentage (74%) have had occasions to use their systems, and a very high 90% stated their satisfaction with the results.

21. FUTURE TECHNOLOGIES

- Dynamic changes are in motion within the DASD marketplace. Driven by a combination of technology improvements and fierce competitive responses aimed at garnering a representative share of the $5 billion data access storage market, disk manufacturers are constantly striving to improve product reliability and increase price/performance ratios.

- Another major reason for the dramatic growth changes taking place in the storage marketplace is the user's shifting emphasis from infatuation with the central processor to the new found realization that memory storage devices are key to meeting future systems and management information processing needs.

- Manufacturers must maintain product leadership if they plan to compete in this competitive environment. It is not a simple matter to accurately forecast emerging technologies and their exact occurrence in the marketplace. However, a number of emerging technologies, which manufacturers concur, offer varying degrees of promise for product implementation during the next several years.

- Before INPUT developed its forecast regarding future technologies, the user community was asked to provide, in their perception, an estimate what new technologies IBM would employ within the next two years.

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- As detailed in Exhibit III-22, respondents saw IBM providing technology enhancements for DBMS hardware, and the inclusion of bubble memories into production products. More specifically, 48 respondents answered the technology forecast question, with 30 (63%) anticipating initial hardware support for DBMS: twenty-three, or 48%, believe IBM will provide bubble capabilities, both within the two year time cycle.

- Texas Instruments' bubble developments are evidently known to the user community which gives credence to the high probability placed on IBM following suit with bubble integration in selected product areas.

- The hope that DBMS will quickly utilize some type of hardware support is understandable. Recent developments involving disk cache memories, front/back end DB processors, and IBM's cautious use of limited hardware integration for IMS/VS Fast Path, all provide encouragement for early use of DBMS hardware to improve performance.

- However, the combination of answers indicating "no" or "don't know" represented the largest response to the various technology questions. With the exception of bubble memories and DBMS hardware aids, all other technology questions have longer user integration periods.

- Vendors are projecting early use of thin film heads and multiple actuators in disk storage devices commencing in 1980, as depicted in Exhibit III-23. The integration of thin film technology, supported by multiple actuators, will provide users with increased performance and improved reliability. In addition, high energy oxides will also be employed, thus increasing storage densities, reducing error rates, and generally improving the overall data life of the disk storage.

- Regarding early implementation of magnetic bubble (MB) technology in product offerings, INPUT forecasts no appreciable impact until the middle 1980s, as shown in Exhibit III-24. Currently, MBs have been utilized in products where the following characteristics are present:

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EXHIBIT III-22

LARGE SCALE USERS

PROJECTIONS OF NEW IBM TECHNOLOGIES IN THE 1980-1981 TIMEFRAME

TECHNOLOGY ADVANCE	YES		NO		DON'T KNOW		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
BUBBLE MEMORIES	23	48%	18	37%	7	15%	48
CHARGE COUPLED DEVISES	11	23	15	31	22	46	48
FLAT PLANE GAS DISCHARGE CRTS	15	31	10	21	23	48	48
HARDWARE DBMS	30	63	11	23	7	14	48
THIN FILM HEADS FOR TAPES	13	27	6	13	28	60	47

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EXHIBIT III-23

NEW DISK TECHNOLOGIES (VENDOR)

VENDOR NUMBER	MEDIA TYPE	FLUX CHANGES/ INCH	TRACKS/ INCH	BITS/ INCH	HEADS	ACTUATORS	ACCESS MECHANISM (MILLISECONDS)	TRANSFER RATE* (MEGABITS/SEC)	YEAR
1	N/A	N/A	N/A	N/A	THIN FILM	MULTIPLE	N/A	2.5	N/A
2	N/A	10K	N/A	10K	N/A	MULTIPLE	N/A	N/A	N/A
3	14" & 8"	12K	750	8K	THIN INDUCTIVE	LINEAR	20-30	1.2	1980
4	N/A	N/A	N/A	N/A	N/A	N/A	20	1.2	N/A
5	14" & 8"	120K	5,000	100-120K	THIN FILM	VOICE COIL (12MS)	8-13	100	1995
6	PLASTIC/GLASS SANDWICH	N/A	N/A	N/A	N/A	AIR	TRACK RECORD MODE	N/A	N/A
7	14" & 8"	20K	700	15K	THIN FILM	MULTIPLE	25	3	1980
8	N/A	10.0	960	N/A	THIN FILM	MULTIPLE	25	4-5	1980
9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	14" & 8" THIN OXIDE	50K	2,500	90-125	THIN FILM	MULTIPLE	10-15	75	1988
11	14" & 8"	10K	N/A	N/A	THIN FILM	MULTIPLE	30	2.5	1980
1980-1981 AVERAGE	-	12.4K	803.3	11.0K	-	-	25.5	2.5	-
1988-1995 AVERAGE	-	85K	3,800	95-123K	-	-	9-14	87.0	-

SOURCE: MASS STORAGE AND OTHER PERIPHERAL DEVICES: COST, PERFORMANCE, AND FUTURE DIRECTIONS. INPUT. DECEMBER 1979
N/A = NO ANSWER
*BETWEEN CONTROLLER AND CPU

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EXHIBIT III-24

MAGNETIC BUBBLE TECHNOLOGY
CHARACTERISTICS IN PRODUCT OFFERINGS

PRODUCT TYPE	TRANSFER RATE (MB/SEC)	AVERAGE ACCESS TIME (MB/SEC)	PRICE (MILLICENT/ BIT)
BUBBLE MEMORY SYSTEM	.80	500.	580.
TERMINAL MEMORY SYSTEM	NA	<10.	280.
BUBBLE MEMORY CHIP	.055	3.	100.

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- Limited storage capacities.

- High access times, because MBs are generally serial in nature (block random access).

- Slow transfer rates due to current serial problems. Future transfer developments will see parallel transfers.

- High price compared to others.

- Non-volatile memory.

- Extremely low power requirements.

- Price (millicent/bit) is high.

- To date, the above characteristics apply to terminal and calculator products, and this is where the industry initially has directed MB product integration.

- Future product opportunities are evident for MBs as flexible disk replacements and some memory replacements, depending upon the application. In the disk area, MBs could potentially provide the following capabilities:

  - Three to six times the bit rate of a floppy disk.

  - One-tenth the power requirements.

  - One-tenth the size.

  - An improved error rate of 1,500 times better than the floppy.

- In the memory replacement area, size, reliability, and power all provide desirable characteristics as a memory adjunct or direct replacement.

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22. INDUSTRY ARCHITECTURE STANDARDIZATION

- Users had positive responses regarding the standardization of architecture. As stated in Exhibit III-25, forty-eight respondents indicated that both the user community and the industry would benefit from this decision.

- The responses can be viewed as a strong endorsement for PC vendors. The answers confirm that the user community looks to vendors to provide compatibility between systems and products; which, in turn, provides the user flexibility and the vendor a potentially larger market share.

- Selected statements from individual respondents show their reasoning for standardization as well as some concerns about the standardization issue and IBM.

  - Architectural Standardization - "Its about time. I'm tired to paying for systems programmers. When hardware gets inexpensive and large enough, you can get away with less tailoring and become a little more inefficient."

  - Benefits from Standardization - "The more standards we have the better off we will be. I think IBM will do something to kill the PC devices! I don't know what, but I think they will change the whole ball game."

23. SYSTEMS SOFTWARE

- Large scale EDP users indicated they are in a period of transition regarding systems software. To better comprehend this transition, questions spanned:

  - "Do you plan to change/add systems software in the next three years?" Forty-seven users responded:

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EXHIBIT III-25

LARGE SCALE USERS

REACTION TO THE CONCEPT OF INDUSTRY

ARCHITECTURAL STANDARDIZATION

QUESTION	YES		NO		DON'T KNOW		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
WILL THE INDUSTRY BENEFIT?	38	79%	8	17%	2	4%	48
WILL THE USER BENEFIT?	39	81	7	15	2	4	48

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Answer	Number of Respondents	Percent
Yes	35	75%
No	12	25
Total	47	100%

- "When do you plan to implement these changes?" Thirty-two users answered:

Year	Number of Respondents	Percent
1	22	69%
2	8	25
3	2	6
Total	32	100%

- "Will this software be used for present or on-order equipment?" Thirty six respondents planned to use the software on:

Equipment	Number of Respondents	Percent
Present	22	62%
On Order	7	19
Other	7	19
Total	36	100%

- "Where do you acquire your systems software?" There are multiple answers to this quesiton, therefore answer percentages are provided rather than number of respondents.

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Vendor Type	Number of Answers	Percent
Mainframe	46	64%
Non-Mainframe	21	29
Independent Contractor	5	7
Other	-	-
Total	72	100%

- "What is the estimated budget for systems software by vendor type categories?" Multiple answers indicated:

Vendor Type	Number of Answers	Budget ($000)	Percent
Mainframe	46	$1,456	81%
Non-Mainframe	21	336	18
Independent Contractor	5	15	1
Other	-	-	-
Total	72	$1,807	100%

- In summary, large-scale users will be spending 81% of their systems development dollars with mainframe vendors on current equipment within a 12 month budget period.

- Some confirmation of the "in place" manufacturers' control derives from the question: "Do you anticipate changes in these divisions by year end 1981?" Only 7 of 48 respondents anticipated any change at all.

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24. APPLICATIONS SOFTWARE

- Applications software opportunities do not exist for mainframe vendors. Here the situation is completely reversed from those conclusions reached in the systems software analysis. From the large scale EDP user's viewpoint, the only category who will get this business - is him!

- Forty-eight respondents were requested to answer questions relating to application software requirements: To the first question about where the software is acquired, the users provided multiple answers indicating:

Vendor Type	Number of Answers	Percent
Mainframe	11	11%
Non-Mainframe	22	22
Independent Contractor	23	22
Internal Developments	46	45
Total	102	100%

- The second question concerned estimated budgets for application software. To this, the respondents answered:

Vendor Type	Budget ($000)	Percent
Mainframe	$ 260	1%
Non-Mainframe	1,470	4
Independent Contractor	700	1
Internal Developments	38,040	94
Total	$40,470	100%

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- The bottom line decision is dollars, and the large-scale users will do their own applications development. The small pittance allocated to mainframe vendors is hardly calculable. The independent contractor might now be able to buy a cup for his pencils, and the non-mainframe vendors are looking at a marginal $31,000 per respondent.

- Why are the applications software budgets so tightly controlled by the large-scale EDP users? Some of the arguments presented by the users were:

  - "If it's done here, it must be right."

  - "Only we know and understand our business - can't afford the time to indoctrinate outsiders."

  - "In-house applications software development expands and protects budgets."

  - "It's proprietary."

25. UTILITY SOFTWARE

- Forty-eight large scale users responded to questions concerning the status of utilization of three utility programs.

  - Data Base Management Systems.

  - Storage Manager Software Packages.

  - Security Packages.

  The answers to these questions are presented in Exhibit III-26.

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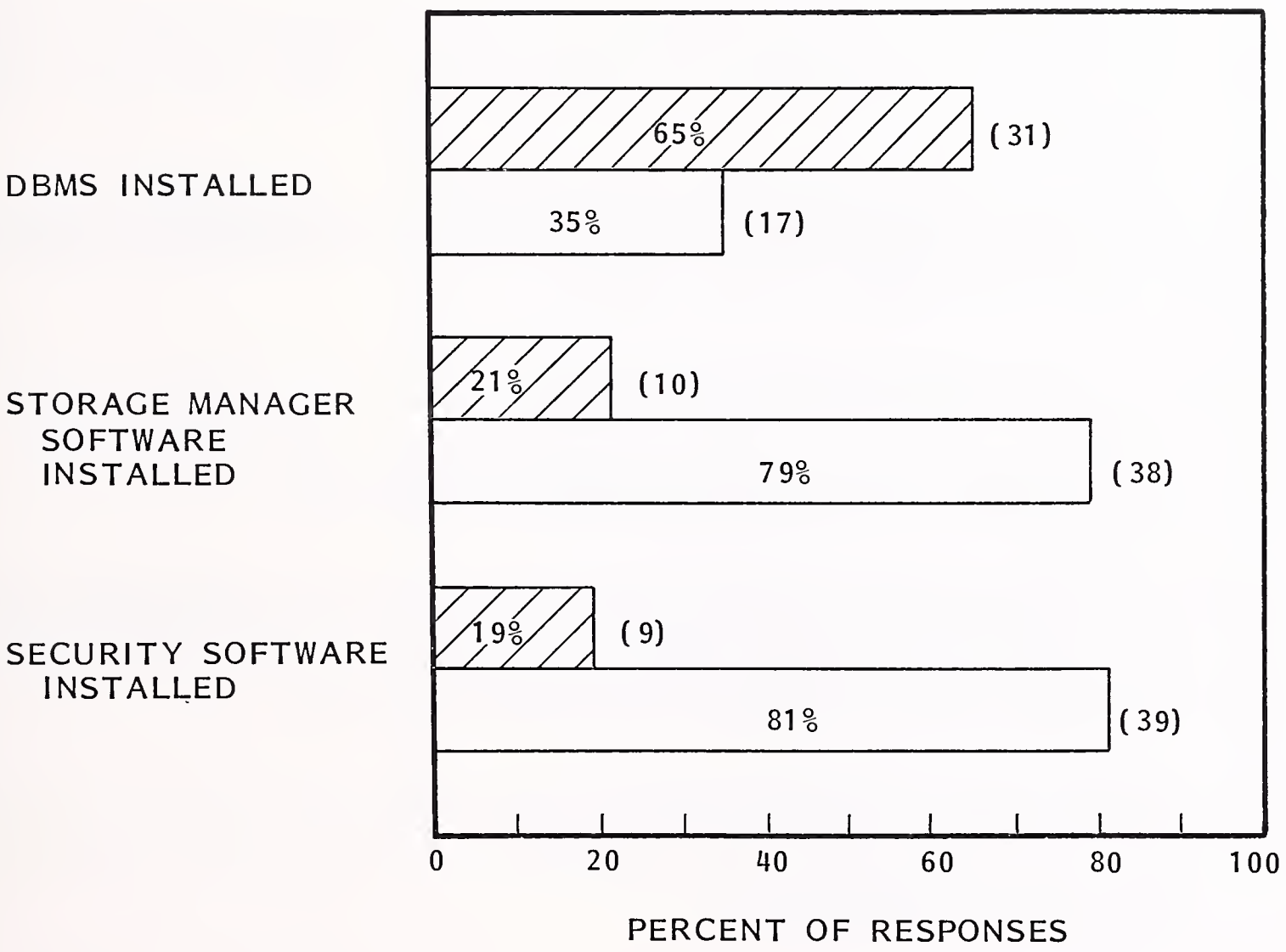
EXHIBIT III-26

LARGE SCALE USERS
STATUS OF UTILIZATION OF UTILITY
SOFTWARE PACKAGES



NUMBER OF RESPONSES = 48

☒ YES
☐ NO

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a. Data Base Management Systems (DBMS)

- Respondents were asked to comment on the use of DBMS software. Sixty-five percent, or 31, of the large mainframe users currently have an installed DBMS.

- In a complementary study previously conducted by INPUT, the question was pursued in greater detail, and the results are provided in Exhibit III-27.

- The results derived from Exhibit III-27 interviews are most informative, but do raise several key questions. To begin with, 22 large central site users indicated:

  - Seventy-three percent use DBMS. The percentage parallels the answer in Exhibit III-26.

  - Twenty-seven percent use no DBMS.

- The second part of the question explored future DBMS plans.

  - Sixty-four percent did not know future planning actions for DBMS. This was not an information question but rather a planning issue with the respondents responsible for future DBMS directions.

- The last question addressed required improvements within DBMS software. Here, the answers were most disappointing, with 73% of the respondents answering "don't know."

b. Storage Manager Software Packages

- Forty-eight respondents answered the question regarding whether storage manager software packages are utilized within their data processing organization.

- Surprisingly, only 10, or 21%, currently employ such a software tool.

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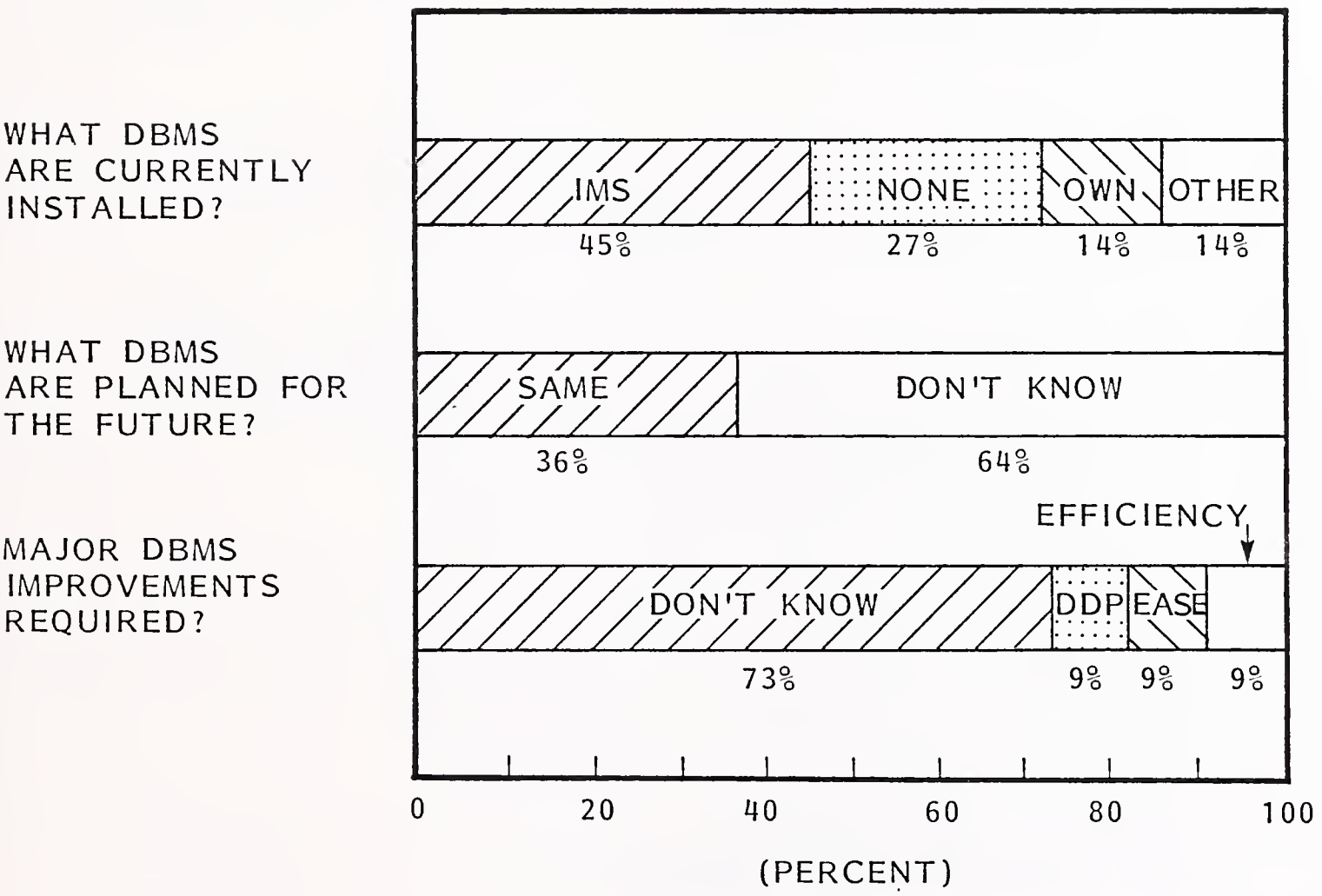
EXHIBIT III-27

DATA BASE MANAGEMENT
SYSTEMS (DBMS) TRENDS



SOURCE: MASS STORAGE AND OTHER PERIPHERAL DEVICES: COST, PERFORMANCE, AND FUTURE DIRECTIONS. INPUT, DECEMBER 1979

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- The 10 respondents who use storage manager packages indicated the following types installed: ASM2, HSM, DMS/OS, D FAST/VS (one installation each). Six "other" packages were installed; there were no installations of DMS.

- There does seem to be a direct correlation between the lack of positive plans concerning DBMS and the use of storage manager software packages. In both cases, the user community requires additional insight into the benefits derived from each package.

c. Security Packages Usage

- The use of security packages is not oversubscribed by the large scale CPU user community. Out of 48 respondents, only 9, or 19%, have such a package installed. The remaining 81% do not.

- The nine large scale users of security packages have installed ~~RAEF~~ RACF (one user); ACF2 (two users); SECURE (two users). Four large scale users reported "other" security packages in use.

- Discussions with respondents during the interviews concluded that the overwhelming majority believed that the security question was not an issue in their organization. One respondent said that the only reason they installed a security package was "to get audit off their backs."

- Some respondents indicated that if security becomes an issue at some future time, the use of packages would then be evaluated.

26. COMPATIBLE OPERATING SYSTEMS OTHER THAN IBM

- The question regarding acquisiton of an operating system other than IBM's, was not favorably received, as shown in Exhibit III-28. Twenty-five percent of the respondents indicated approval. Seventy-five percent said "no" to the question.

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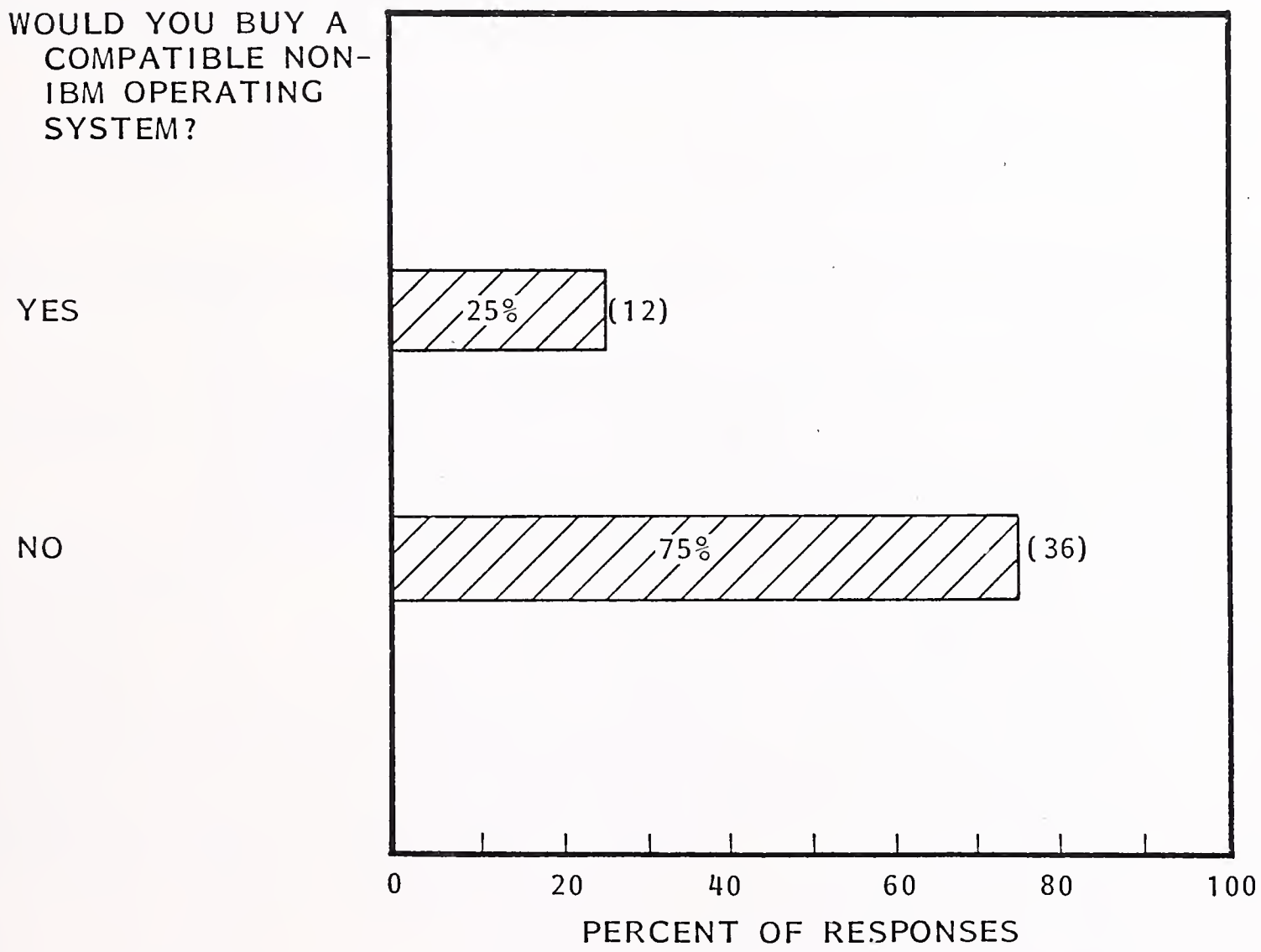
EXHIBIT III-28

LARGE SCALE USERS
ACCEPTANCE OF COMPATIBLE NON-IBM OPERATING SYSTEMS



NUMBER OF RESPONSES = 48

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- There is a deep rooted fear within the user community that deviating from IBM software may eventually place the user in a position of no return. As a result, users are most cautious when leaving IBM's protective software umbrella. They are confident in making alternative hardware decisions based upon the performance of the PC vendors. Software, on the other hand, has too many unknowns, especially with the knowledge that software will be IBM's major revenue thrust in the coming years, and IBM will be most aggressive when protecting this investment.

- Some of the more constant concerns expressed by the users regarding software migration away from IBM are:

  - IBM will retaliate.

  - Other vendors won't provide on-going support.

  - Future developments will be hit and miss.

  - Will get into too many problems.

- Users who would consider acquiring a compatible operating system other than IBM's are the typical industry mavericks who find delight and challenge in mixing and matching hardware and software. Also, they delight in tweaking IBM's nose and are not concerned about IBM counter measures. Unfortunately for PC vendors who are contemplating OS software offerings, this is a small market segment and provides a marginal return in investment unless the manufacturer has a large, loyal, established base and provides a total systems capability, including peripherals.

27. SYSTEMS SUPPORT CENTERS

- The systems support center program appears to be a winner for IBM. Of the 48 respondents, 45 are familiar with the program and 27 are active participants, as detailed in Exhibit III-29.

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EXHIBIT III-29

LARGE SCALE USERS
RESPONDENT USERS' EXPOSURE TO IBM SYSTEM SUPPORT CENTERS

EXPOSURE	YES		NO		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
KNOWLEDGE OF IBM SYSTEM SUPPORT CENTERS?	45	94%	3	6%	48
EXPERIENCE WITH SYSTEM SUPPORT CENTERS?	27	59	19	41	46

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- Of those who are participating in the support center program, the vast majority enthusiastically endorse IBM's performance so far.

- Users of the support center program voiced a number of positive statements concerning IBM's involvement.

  - Better than on-site service.

  - Higher caliber of personnel available.

  - Answers to problems are much faster.

  - Concentration of personnel resources provides much broader experience and coverage when problems occur.

- Naturally, not everyone was totally satisfied. A few dissenters expressed concern with the program.

  - They are left hanging on phone calls and are sometimes disconnected.

  - On-site support was better.

  - Liked the eyeball to eyeball approach with "their" field engineer.

- Regardless of the negative comments, the support center concept is here to stay and, overall, IBM has done an outstanding piece of work to make it palatable in the early stages. Surely, it has established a de facto standard for other field engineering organizations to emulate and follow.

28. MAINTENANCE SOURCES AND ATTITUDES

- The information compiled in Exhibit III-30 indicates that 75% of the respondents currently have mixed equipment from plug compatible vendors and IBM alike.

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EXHIBIT III-30

LARGE SCALE USERS

ATTITUDES TOWARD SOURCE OF MAINTENANCE

SOURCE OF MAINTENANCE	YES		NO		MAYBE		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
MIXED IBM AND PC OPERATING TODAY	36	75%	12	25%	–	–	48
CONSIDER CONTRACTING ALL MAINTENANCE TO PC SUPPLIER	2	6	27	75	7	19%	36
CONSIDER CONTRACTING TO PC SUPPLIER IF IBM A SUBCONTRACTOR	13	38	17	50	4	12	34

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- A question was posed dealing with contracting all maintenance for all equipment with a PC vendor. The 75% majority who would not contract with a PC vendor provided additional insight as to their reluctance to do so:

  - Poor maintenance from PC vendors in the past.

  - Difficult to find a single PC vendor who could provide both mainframe and peripheral maintenance support.

  - Sets up too many problems for the user to unravel or adjudicate.

  - "The guy who makes it should fix it."

  - It won't work.

  - IBM's service is unequalled.

  - Need IBM's security blanket.

- The majority of the respondents' answers centered on the concern and ability of the potential PC vendor to adequately service both mainframes and peripherals, especially for those products the PC vendor does not manufacture.

- In addition, the more knowledgeable users questioned the economies of scale associated with a PC vendor carrying inventories, training personnel at IBM's training facilities, and eventually developing remote software diagnostic aids for IBM units. Collectively, they believed the end result would be a higher cost of maintenance with degraded service than that of IBM's. Finally, it was all summarized by a respondent who said, "It doesn't make sense."

- Respondents were somewhat more positive concerning the alternative of contracting all maintenance to one PC vendor if IBM equipment is maintained by subcontract to IBM. Thirty-eight percent answered yes, 12% said maybe and 50% said no. Here again, respondents' comments expressed concern about

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the ability of one PC vendor being able to provide adequate maintenance service for products he knows nothing about.

29. DEGREE OF MAINTENANCE PARTICIPATION

- A series of questions, depicted in Exhibit III-31, were asked regarding the user's participation level in assisting with various maintenance functions. Clearly, the answers indicate an interest to participate, but not to the point where it directly infringes on the maintenance prerogatives of the vendor nor where maintenance training would be required for the user's personnel.

- Manufacturers can expect an increased amount of participation in locating and isolating maintenance problems from their users. Once this point is passed, and users are requested to either deliver, replace, or repair units, their interest level decreases dramatically. Manufacturers can best get their users participation if diagnostic and isolation tools are provided and joint remedial action undertaken.

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EXHIBIT III-31

LARGE SCALE USERS
WILLINGNESS TO PARTICIPATE IN MAINTENANCE TASKS

WOULD USER BE WILLING TO:	DO IT YOURSELF?		COOPERATE WITH VENDOR		NOT AT ALL		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
RUN DIAGNOSTICS?	23	50%	16	35%	7	15%	46
REPLACE BOARDS?	14	30	15	33	17	37	46
DELIVER/PICK UP TO CENTRAL REPAIR DEPOT?	6	13	13	28	27	59	46
COMPONENT LEVEL REPAIR?	2	4	6	13	38	83	46

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B. MEDIUM RANGE USERS

- IBM medium range CPU users have been exposed to the announcement of the 4300 series. Therefore, their reactions to plug compatible alternatives to IBM products are especially significant.

1. CURRENT INSTALLED AND ON ORDER POSITION

- Exhibit A-1 (see Appendix A, Exhibit A-1: CPUs Installed Or On Order By Respondents) presents a very clear picture of the current status of the impact of the 4300 in the IBM medium range systems market.

  - The sample of 50 medium range users had 58 CPUs installed. Only one CPU was non-IBM.

  - These 50 installations currently have 55 mainframes on order: 47 are 4300 series, and the remaining 8 are all IBM systems.

  - This confirms quite dramatically the reported order backlog (and theoretically acceptance) of the 4300 series.

  - It fails to reflect any dissatisfaction which may have resulted from delivery schedules. (Users did not cancel their orders even though dissatisfied.) In fact, the medium range users seem resigned to slow IBM delivery - to quote one user, "You may not like it, but what can you do."

- The current status of the disk storage market is not nearly so clear (see Appendix A, Exhibit A-2: Disk Drives Installed Or On Order By Respondents).

  - Medium range users have 386 disk drives installed on the 58 systems, an average of 6.7 per system.

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- Approximately 80% (307 drives) are IBM and 20% (79 drives) are those of other vendors.

- The respondents reported only 69 drives on order. Of these, 94% (65 drives) were IBM and only 4 drives were from other vendors.

- The on-order position requires clarification since it can be misleading.

  . Detailed analysis reveals that respondents frequently reported they had a 4300 series system on order without reporting 3370 disk orders. It is felt that this is probably an oversight on the part of the respondent - either because he did not know or was not currently concerned about specific configurations for systems on extended delivery schedules.

  . The low on-order position for plug compatible drives may be the result of PC vendors being able to fill orders promptly.

- The situation with tape drives parallels that with disk drives (see Appendix A, Exhibit A-3: Tapes Installed Or On Order By Respondents).

  - Users currently have 217 tape drives installed (3.7 per system); 82% (178 drives) are IBM and 18% (39 drives) are plug compatible.

  - Twenty-four drives are on order; all of these are IBM. The same comments made for disk drives apply to tape:

    . It does not appear users reported drives on order for the 4300 series.

    . It is possible the lack of PC tape drives on order may reflect fast delivery of such drives.

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- Exhibit A-4 (see Appendix A, Exhibit A-4: Printer Equipment Installed Or On Order By Respondents) demonstrates that medium range users prefer IBM printers overwhelmingly. There were 63 printers installed (1.1 per system) and only one (1.4%) was non-IBM. Of the 9 printers on order, none was non-IBM.

- Not unexpectedly, terminals present a somewhat brighter picture for plug compatible vendors (see Appendix A, Exhibit A-5: Terminals Installed Or On Order By Respondents).

  - There are a total of 1,527 terminals of various types installed on the mid-range systems, an average of 28 per system. Only three systems do not have any terminals installed.

  - IBM has 79% of the total terminals (1,200 units) against 21% (327 units) for other vendors. However, of the 483 terminal unit backlog, plug compatible equipment represents 32% (153 units). This is substantially better than any other plug compatible penetration in the medium range sample, and it indicates the possibility of breaking the "20% PC penetration level" in the medium range CPU market.

- In summary, there is currently very little medium range penetration of plug compatible mainframes or printers. There is approximately a 20% penetration for disks, tapes, and terminals. There is very little on-order plug compatible equipment except for terminals, where over 30% of the backlog is from PC vendors.

2. TIMESHARING USAGE AND PLANS

- Even though a high percentage of medium range systems have terminals attached (95%), only 18% (9 systems) had installed an in-house timesharing system, represented in Exhibit III-32.

- While one timesharing user reported as high as 43 active users, the average was approximately 15 active users, as shown in Exhibit III-33. This would

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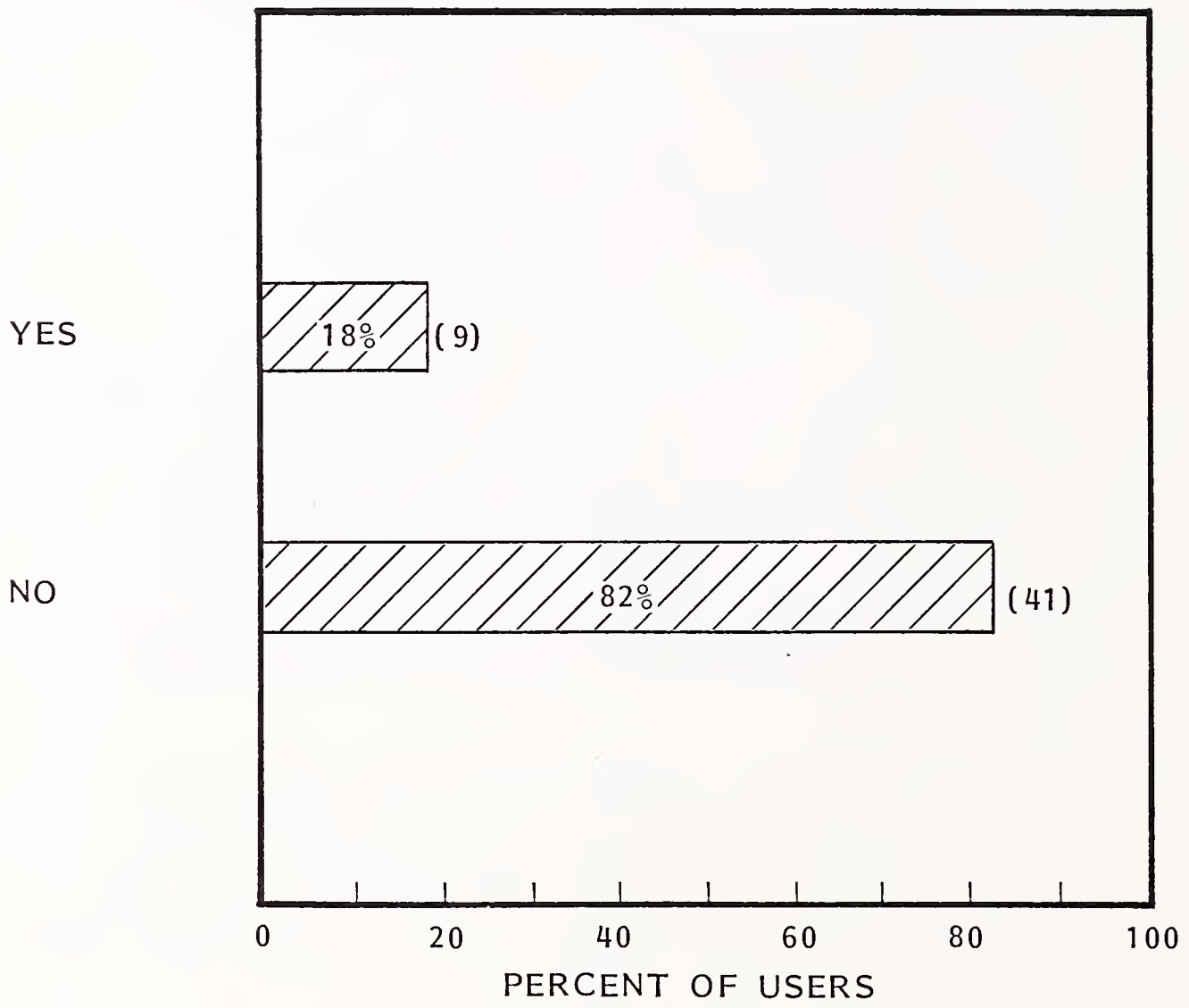
EXHIBIT III-32

MEDIUM RANGE USERS
PERCENT OF RESPONDENT USERS WITH IN-HOUSE TIMESHARING



NUMBER OF RESPONSES = 50

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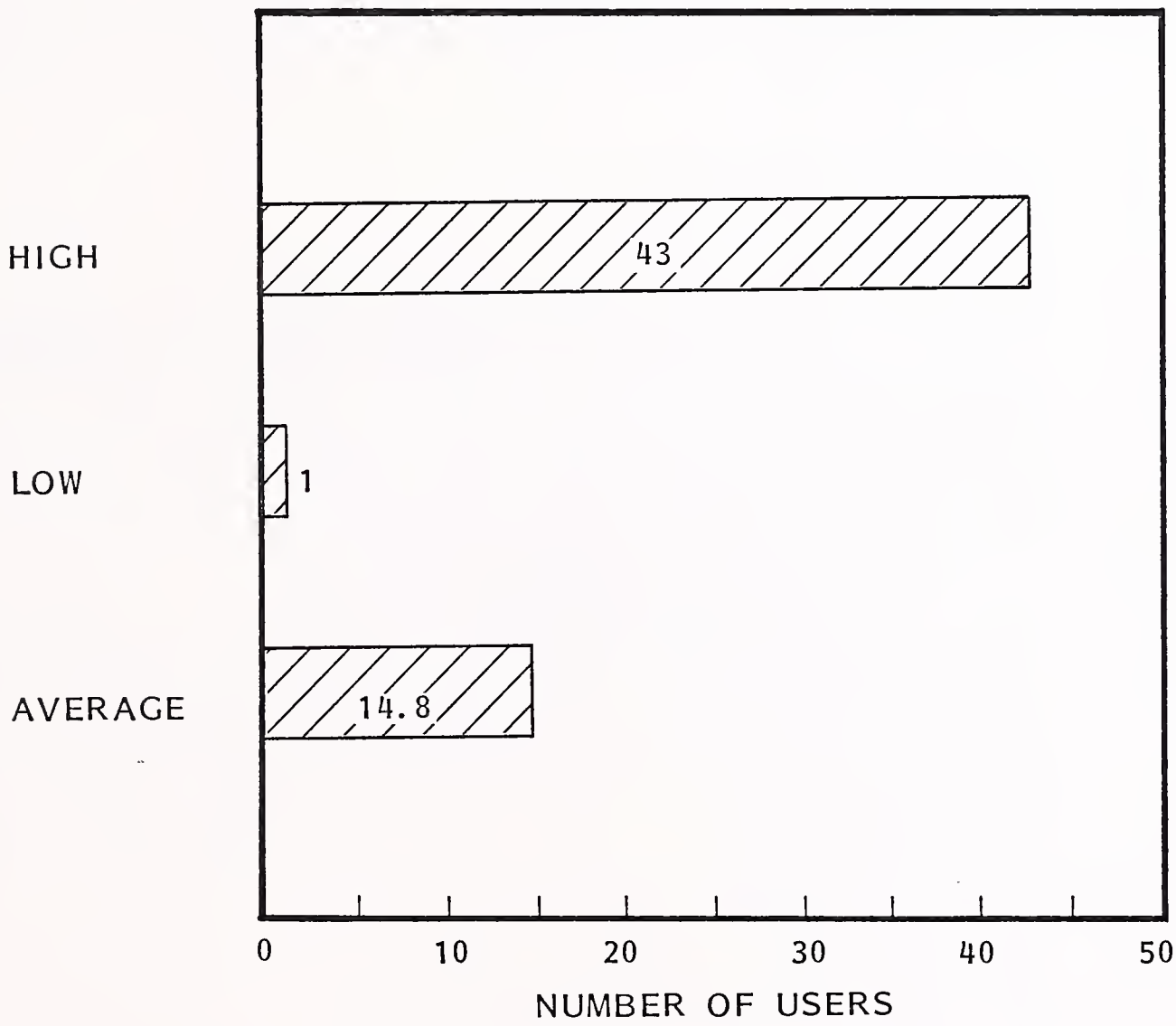
EXHIBIT III-33

MEDIUM RANGE USERS
AVERAGE NUMBER OF TIMESHARING USERS
ON-LINE AT ANY ONE TIME



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indicate that less than 10% of the active terminals associated with medium range systems are used for timesharing.

- It can be concluded that medium range timesharing does not represent a significant market which will carry along any major increases in storage or terminals. This is probably the result of the poor performance of IBM timesharing systems (especially in a mixed environment of timesharing, batch, and other interactive processing). Large mainframes are required to support such complex IBM systems software.

3. PURCHASE VERSUS LEASE

- Historically, 40% of the medium range users sampled preferred to purchase equipment, as depicted in Exhibit III-34. However, in light of the 4300 series announcement, 50% of these users indicate they will switch to lease (presumably because of anticipated competitive reactions and activities in the used computer market). (Exhibit III-35.)

- This would indicate that medium range customers will only be purchasing 20% of their equipment during the current period of uncertainty in the marketplace. This confirms the well publicized switch from purchase to lease, which has had such a dramatic impact on current revenues for both IBM and plug compatible vendors.

4. USER REACTIONS TO PC/PCM EQUIPMENT

- Considering the size and geographic distribution of the medium range user sample, a surprisingly high percentage have had some exposure to plug compatible products, shown in Exhibit III-36.

  - Overall, there appears to have been very good sales coverage of the IBM medium range CPU plug compatible market. At least, there is a general realization that there are possible alternatives for IBM users.

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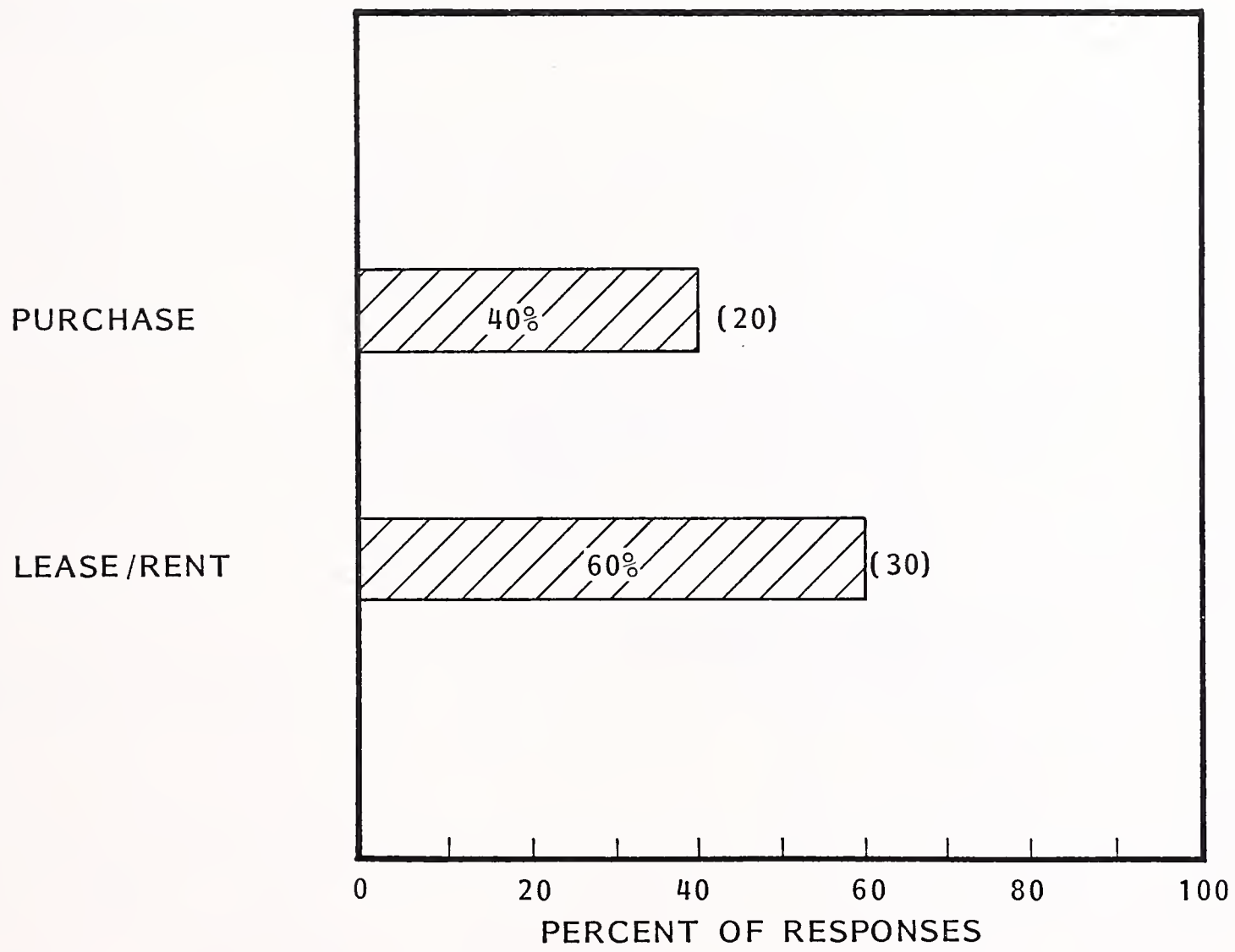
EXHIBIT III-34

MEDIUM RANGE USERS
PRESENT METHOD OF EQUIPMENT ACQUISITION



NUMBER OF RESPONSES = 50

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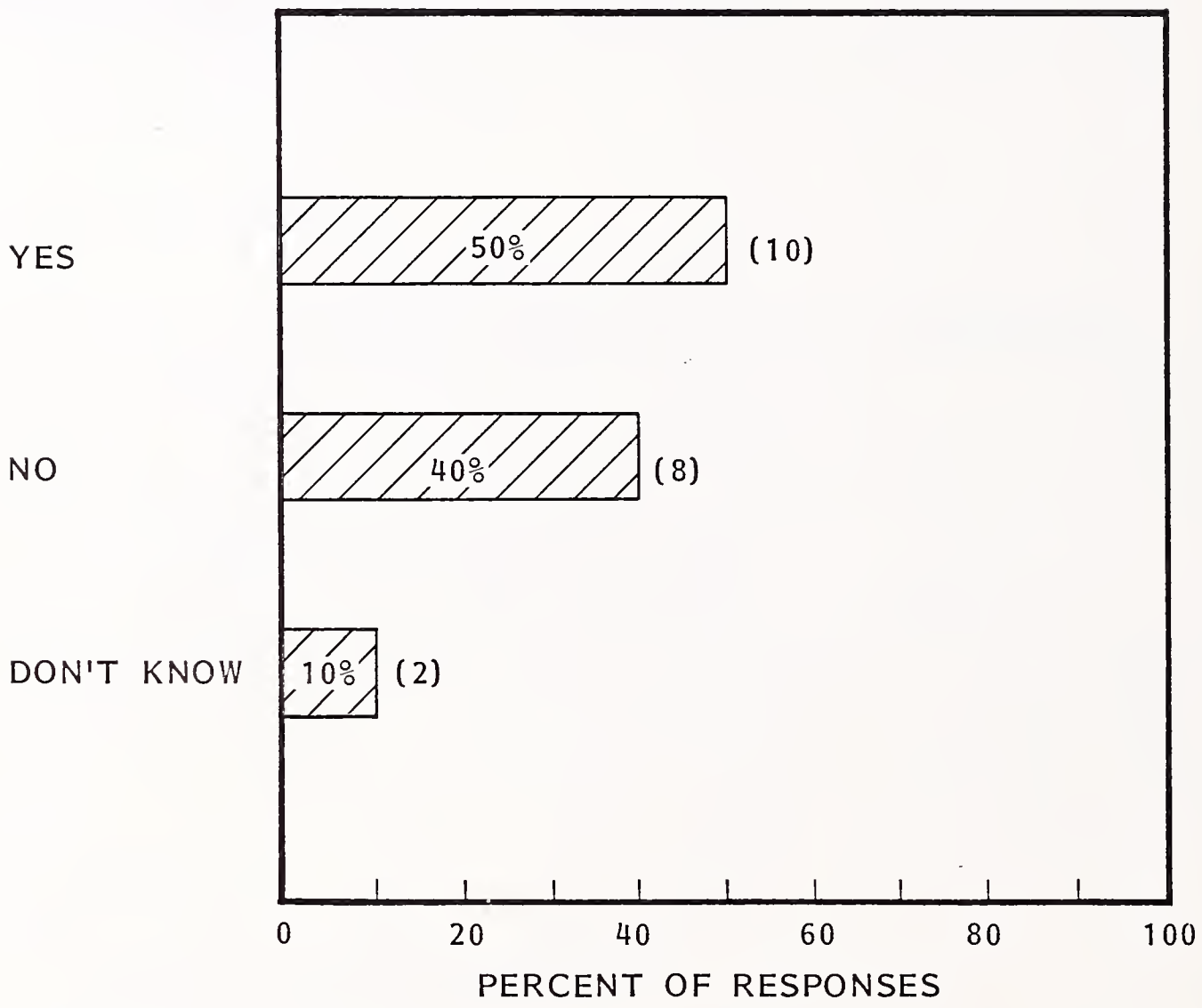
EXHIBIT III-35

MEDIUM RANGE USERS
PERCEIVED CHANGE OF PURCHASE TO LEASE
AS A METHOD OF EQUIPMENT ACQUISITION



NUMBER OF RESPONSES = 20

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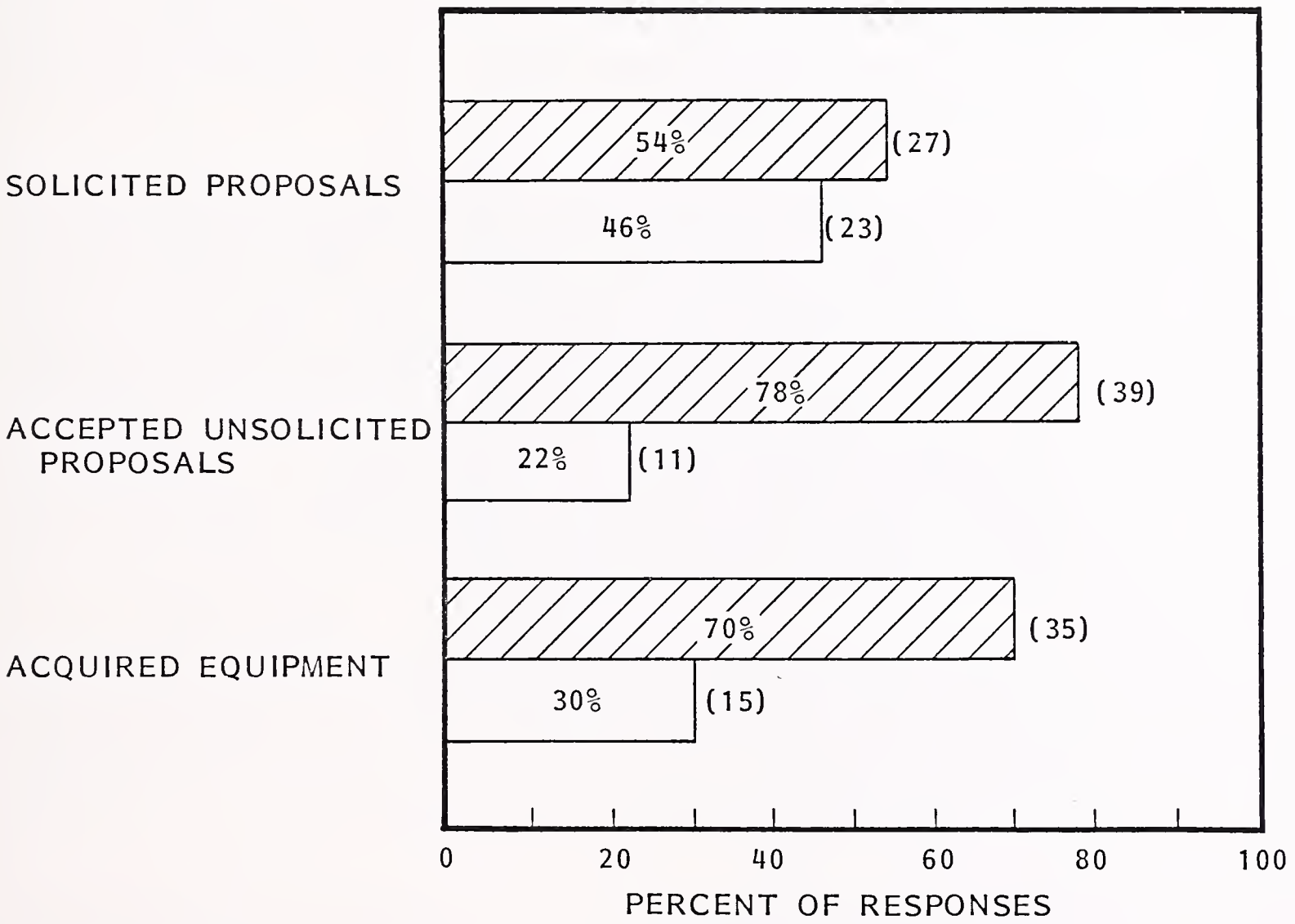
EXHIBIT III-36

MEDIUM RANGE USERS
ACTIONS REGARDING ACQUISITION OF PC/PCM EQUIPMENT



NUMBER OF RESPONSES = 50

YES
NO

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- Based on past INPUT research, cost savings of at least 25% are normally required to prompt any significant hardware or software systems change. It appears that IBM medium range customers are even more resistant to change than the general user population. This conclusion is based on interpretation of the results depicted in Exhibit III-37.

  - Of the users indicating a susceptibility to price differentials (23 respondents), 39% reacted at 20% or below and 61% indicated more than 20% cost savings would be required. This is pretty much in line with past INPUT findings.

  - However, 27 respondents indicated they were not especially susceptible to cost savings. Of these, seven respondents indicated they would not buy from a non-IBM vendor regardless of price. This is a very strong attitude which normally is not openly expressed because it may appear to be irresponsible. (For example, at 50% cost savings it would seem any prudent manager would have to at least try an alternative.) A possible justification for such a strong opinion would be a bad experience with plug compatible products.

  - The "don't know" category (eight respondents) is usually one reserved for those who would prefer not to make such a choice. They hold open the option of accepting a really significant cost savings, but it obviously is not anything they have seriously considered.

  - The "no specific level" category (12 respondents) was generally the result of someone saying: "Price is not important - reliability, service, performance, and capacity are important." The interviewers agreed such a response was generally negative and represented an attitude of "demonstrate the products meet the really important selection criteria, and then we will worry about price."

  - Therefore, the group generally insensitive to price differentials can be considered firmly in the IBM camp (or at least a hard sell). This group

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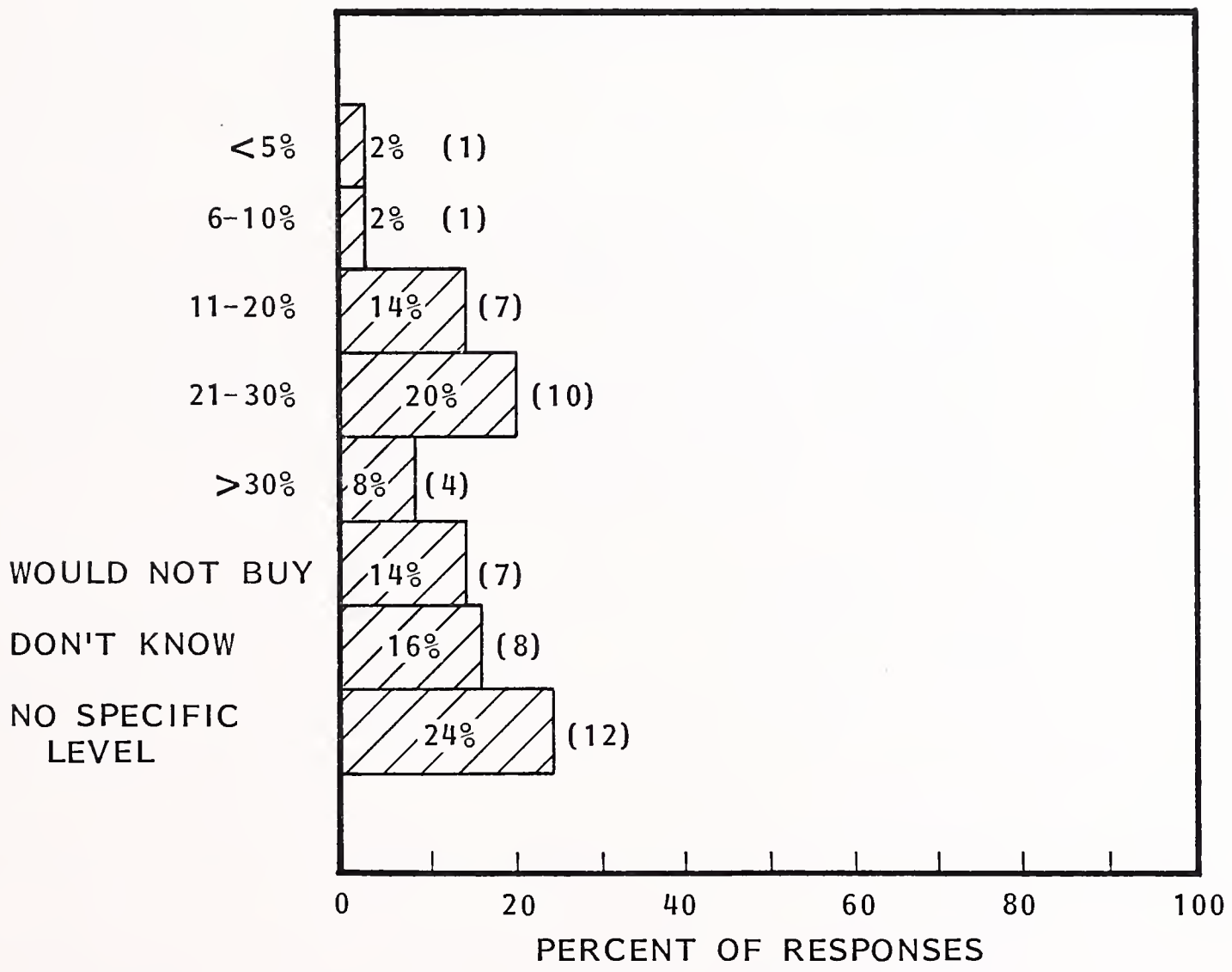
EXHIBIT III-37

MEDIUM RANGE USERS
PRICE SAVINGS LEVELS REQUIRED TO
PURCHASE PC/PCM EQUIPMENT



NUMBER OF RESPONSES = 50

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represents 54% of the total medium range sample. It closely approximates the number of respondents who had no plug compatible equipment installed, and the number who would not accept new, non-IBM technology (50%), seen in Exhibit III-38.

- Medium range respondents were practically unanimous in stating that "finger-pointing" when something went wrong was of major concern to them in considering plug compatible equipment. Of course, IBM can be accused of finger-pointing as well as competitive vendors. However, when asked for the strengths and weaknesses of PC/PCM vendors, weaknesses predominated.

  - Over 20 medium range respondents stated maintenance and service was a problem. Frequently, this was the result of unavailability of service in the local geographic area - a significant problem for medium range customers in relatively small towns. Other stated weaknesses were as follows:

    . General stability and assets of PC vendors were mentioned as negatives.

    . A purchase only requirement was considered a disadvantage.

    . The problem of multiple vendors was reiterated as a weakness.

    . Reliability and quality of products were also specifically pointed out as problems associated with the following vendors: Calcomp, Telex, Itel, Magnuson, Courier, and Braegen maintenance.

- While most respondents seemed disposed to concentrate on weaknesses, the following vendors were mentioned in a positive sense: Wordstream, STC, Calcomp, Telex, Memorex, Harris, Documation, and Courier. Obviously customers have mixed reactions to some vendors, since they appear on both lists.

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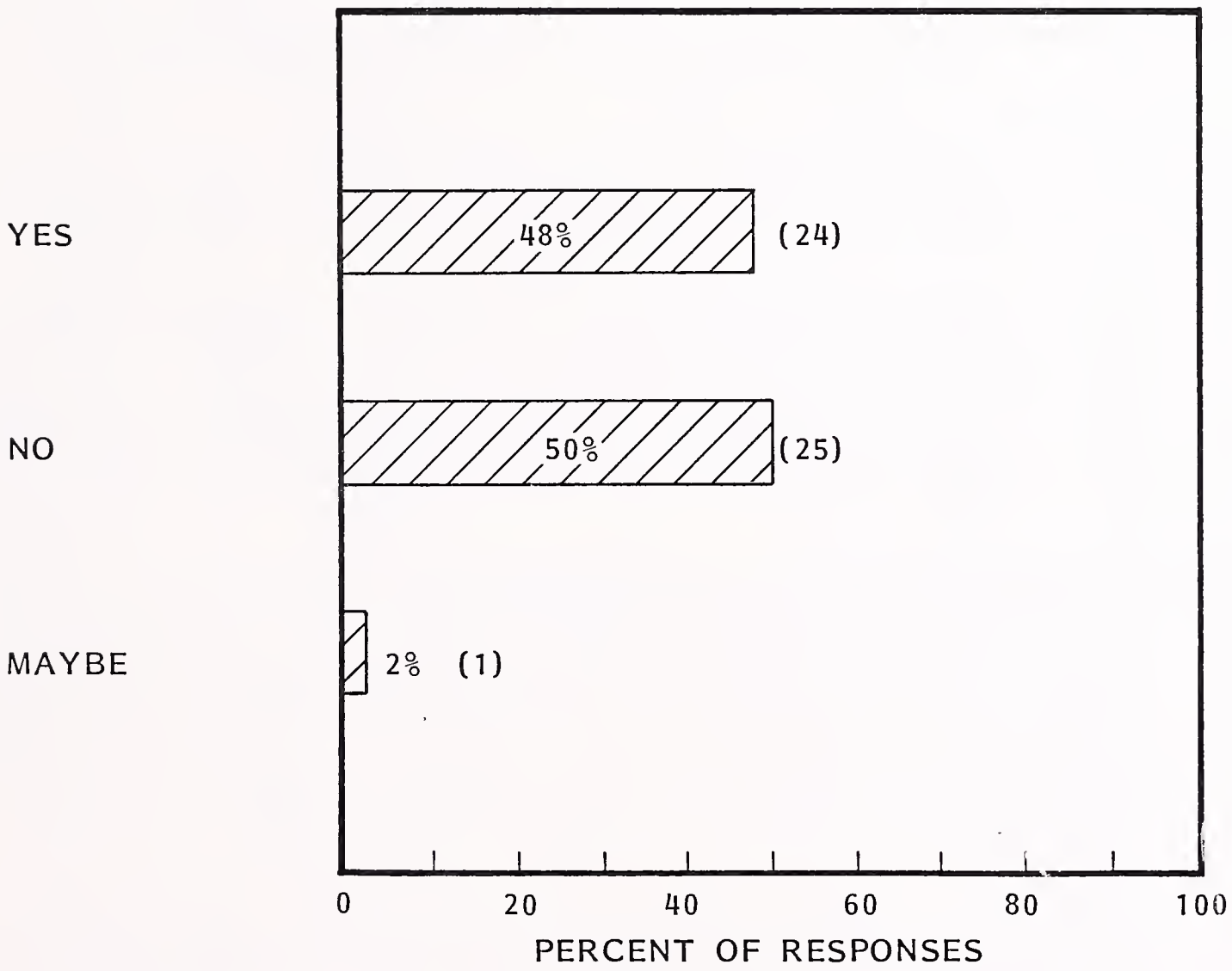
EXHIBIT III-38

MEDIUM RANGE USERS
RESPONDENT USERS' WILLINGNESS TO
ACCEPT NEW NON-IBM TECHNOLOGY PRODUCTS



NUMBER OF RESPONSES = 50

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- The main strengths mentioned were delivery schedules, cost, and specific product quality. When asked why it was felt plug compatible vendors could sell at lower prices, the respondents were quite specific.

  - Thirty-one (a very high response to an open-ended question) felt it was because non-IBM vendors did not have as much overhead or did not have to invest in research and development. (At times, the tone on the latter point had unpleasant connotations of "copying IBM's products," but generally speaking, it was merely a pragmatic observation.)

  - Seventeen stated quite simply that plug compatible vendors had to be cheaper in order to sell and settled for lower profit margins.

  - Eight users saw fit to specify lack of support and quality control.

  - Only one respondent stated that competitors were more efficient than IBM.

- Generally speaking, it was not felt that plug compatible vendors could enhance their competitive position by either specializing or expanding their product lines. Over 70% stated that neither specialization or expansion was important for hardware products. Even when software was added, 60% did not feel such an extension was important, as shown in Exhibit III-39.

- This general response was confirmed when medium range users were asked specifically what "extras" a PCM vendor could offer to enhance his product line. Most users either stated they didn't know or mentioned general things, such as: "better disks," "faster tapes," and "bubble memories." However, nine did specify proprietary software as being a desirable extension.

- When asked for recommendations on how plug compatible vendors could improve their products to encourage sales, the responses were also generally inconclusive.

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EXHIBIT III- 39

MEDIUM RANGE USERS
RESPONDENT USERS' PERCEPTION OF PC/PCM
VENDORS' OFFERINGS OF EXPANDED PRODUCT LINES

PLUG COMPATIBLE VENDOR OFFER	IMPORTANT		SOMEWHAT IMPORTANT		NOT IMPORTANT		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
PERIPHERALS ONLY	8	17%	3	6%	37	77%	48
MAINFRAME ONLY	4	9	2	4	41	87	47
MAINFRAME/ PERIPHERALS	6	13	8	17	34	71	48
ALL ABOVE PLUS SOFTWARE	18	38	1	2	29	60	48

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- Ten mentioned reliability and service which reflects the general, perceived weakness in these areas.

- Fast delivery was mentioned by several as being something PC vendors could do to improve their competitive position.

- Otherwise, the answers can be summarized as merely "fast and cheap."

- A few even saw fit to state there was nothing which could be done to match IBM's products and services.

- When asked which vendors currently offered a viable alternative to IBM products, medium range users seemed to rely heavily on what they had read or seen advertised, rather than on their actual experience. The "mentions" of specific vendors are as follows:

  - Memorex and STC - 13.

  - CDC and Itel - 8. (Two qualified their response about Itel with a "used to be" comment and one stated "National Semiconductor - maybe.")

  - Amdahl - 7.

  - Magnuson - 6.

  - Courier and Documation - 4.

  - Telex and Harris - 3.

  - Raytheon - 2.

  - Four-Phase, Computer Optics and Sycor were all mentioned once. One respondent went so far as to suggest that all PC vendors represented a viable alternative to IBM.

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- When asked which vendors would not survive in their field and why, names were mentioned but few reasons were given. There seemed to be a general reluctance to discuss the subject.

  - Seven respondents mentioned Itel was in trouble.

  - Three mentioned Amdahl and two Magnuson, among the other mainframe vendors.

  - Calcomp, Prime, Braegen, Courier and Computer Optics were all mentioned once without specific reasons.

  - One respondent stated he heard Memorex was having problems.

  - Another stated he was negative on all PCMs, and a kindred spirit stated he would: "Be surprised if any survive."

- There seemed to be a general concensus that the Japanese would enter the computer and peripheral industries in the U.S. marketplace (80% felt this was probable), as reported in Exhibit III-40.

- There was no concensus on exactly how or when they would enter the U.S. market, but most affimative responses indicated they would enter with mainframes or in all areas. The mainframe respondents pointed specifically to the Itel/Hitachi publicity and Fujitsu's investment in Amdahl. The general reaction to Japanese entry into the U.S. marketplace was negative and several stated they "preferred to buy American."

5. STORAGE REQUIREMENTS

- The medium range users' concept of the "Mass Storage Utility" is somewhat surprising. Over 50% viewed it as being a fundamental element of a totally on-line storage system, as shown in Exhibit III-41.

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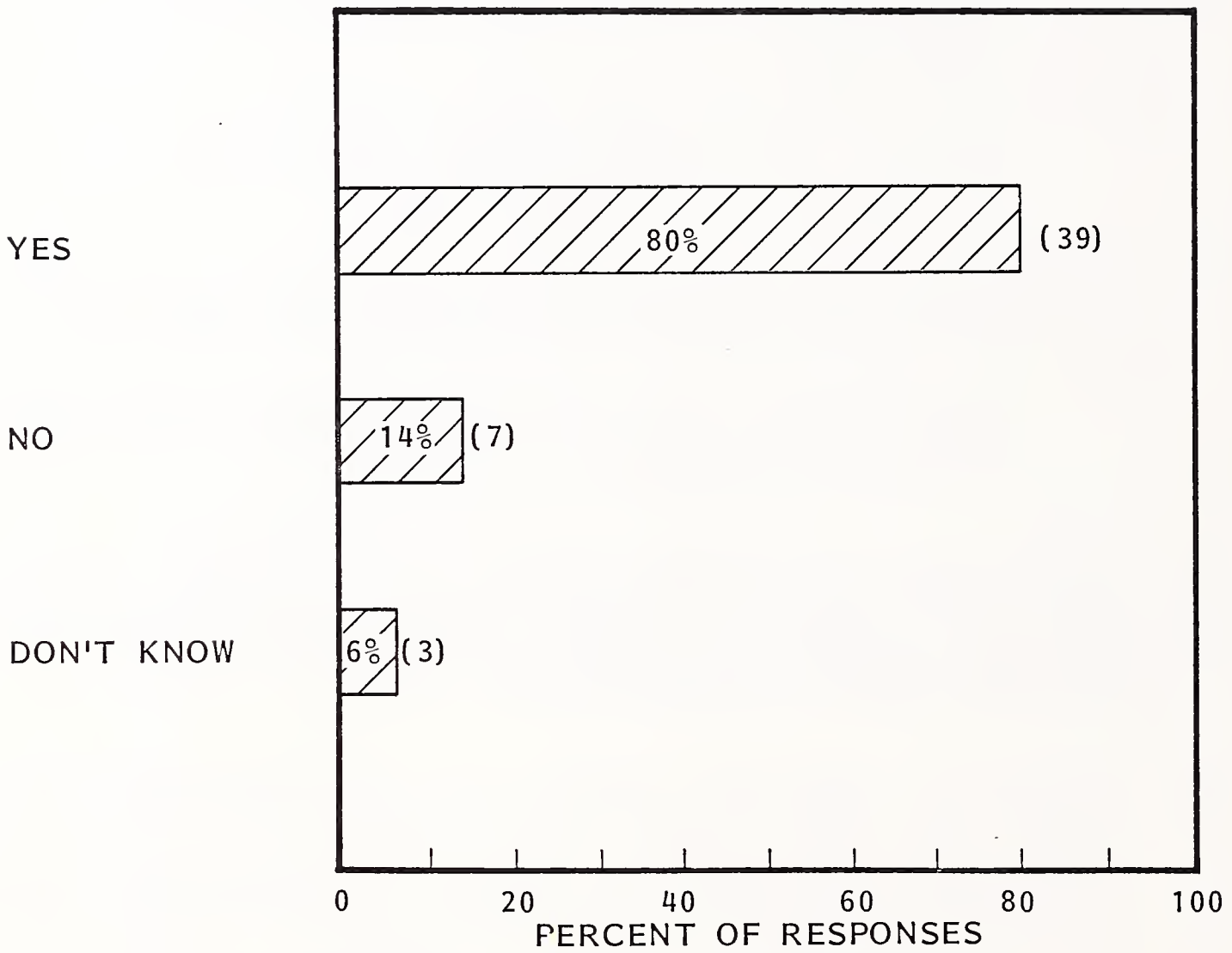
EXHIBIT III-40

MEDIUM RANGE USERS

RESPONDENTS USERS' PERCEPTION OF JAPANESE COMPUTER/PERIPHERAL INDUSTRY AS A POSSIBLE CONTENDER IN THE U.S. MARKETPLACE



NUMBER OF RESPONSES = 50

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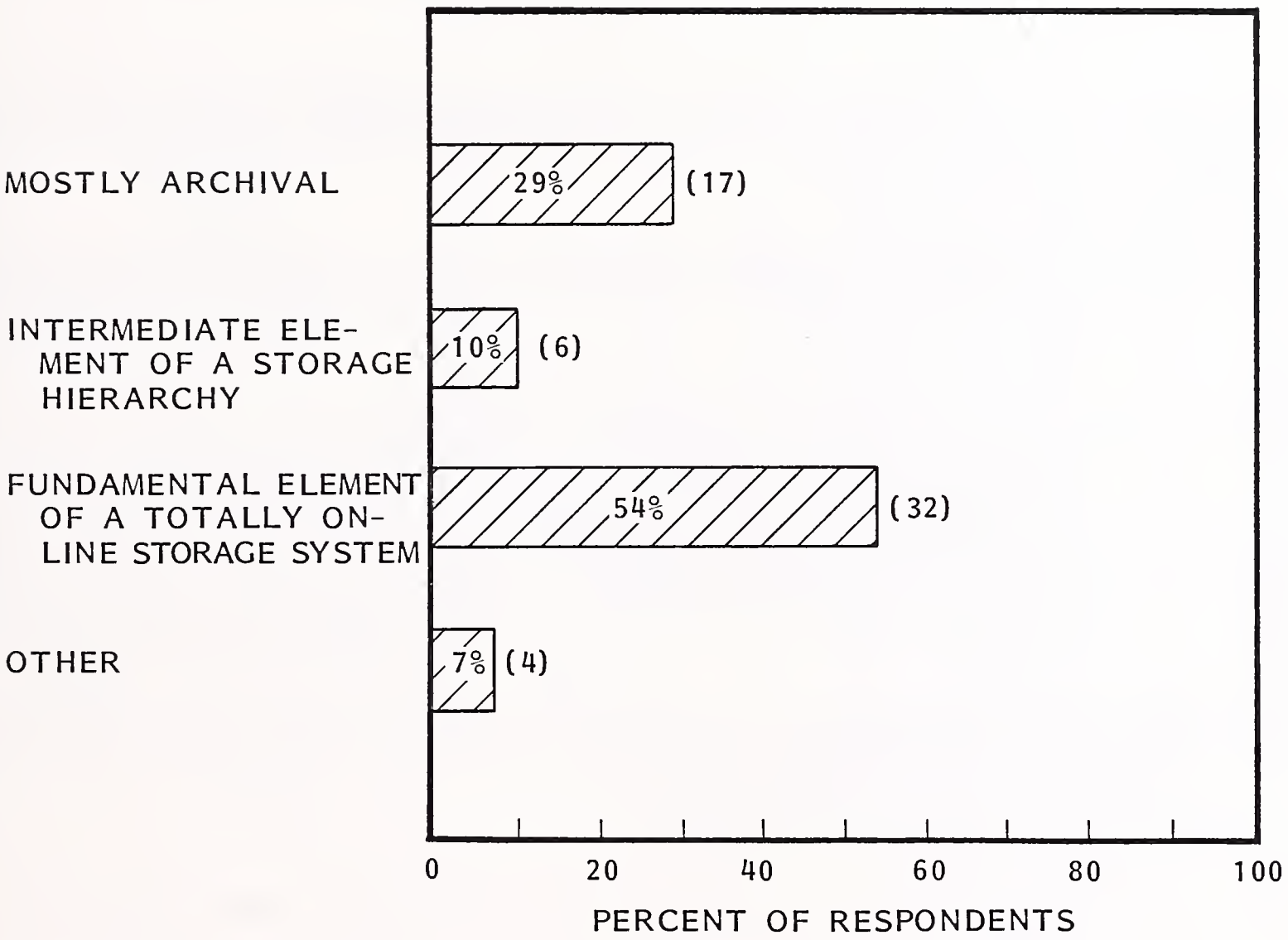
EXHIBIT III-41

MEDIUM RANGE USERS
RESPONDENT USERS' CONCEPT OF THE MASS STORAGE UTILITY IN THE USERS' OPERATION



NUMBER OF RESPONSES = 59

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- On-line storage has been effectively sold by IBM to the degree that even medium range users are considering the possibility of going completely on-line.

- Medium range users did not understand the question (however, their answers closely parallel the large scale users who have been more exposed to the IBM 3850 marketing efforts).

- The capacity and cost of mass storage is viewed as being attractive, either at the current cost per bit of the IBM 3850, or projected to some point in the future.

- The physical handling of tapes is currently viewed as a significant operational problem.

- Users' plans for new applications require cheap mass storage, and they have confidence that either current or new technology will satisfy these requirements. Medium range users have already been offered the 3380 and perhaps some of them interpret this as heralding a "mass storage utility."

• Tape, as a storage medium, varied substatially across the medium range user spectrum, depicted in Exhibit III-42.

  - Tape library size ranged from 25 to 9,000 reels, with an average of 1,276.

  - Tapes used for data storage ranged from 15 to 3,800 reels, with an average of 496 reels.

  - Both extremes demonstrate widely different operating environments in the medium range area, and the high side does point to a possible requirement for an on-line mass storage system.

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EXHIBIT III-42

MEDIUM RANGE USERS
ANALYSIS OF RESPONDENT USERS' TAPE LIBRARIES

MAGNETIC TAPE STORAGE	HIGH	LOW	AVERAGE	TOTAL NUMBER OF RESPONSES
TOTAL TAPE REELS IN LIBRARY	9,000	25	1,276	50
TAPE REELS FOR STORAGE	3,800	15	496	48
PERCENTAGE OF TAPE REELS UTILIZED FOR DATA	100%	5%	41%	46

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- The estimates of percentage of actual tape utilization of data are not surprising; most operations management probably don't know how much data is physically stored on individual reels. It can be concluded that no one uses 100% of all tape reels. Past experience would probably indicate that the average usage is substantially below 41%. In all probability, the user who estimated 5% was concerned enough to know how much data was usually stored on individual reels.

- At the present time, medium range users estimate their total storage is split equally between tape and disk. However, in 1980, there will still be all tape systems and all disk systems. By 1984, the trend towards disk will see 42% of storage on that medium and only 38% on tape. It appears that all systems will have disk installed in 1984, even though one respondent stated 100% of his storage would be on tape, shown in Exhibit III-43. (It is assumed that there was some confusion about data, program, and working storage on the part of some respondents, but the trend towards disk is clear.)

- The estimates of effective percentage of disk used for data storage are probably optimistic (as were those for tape). It is doubtful that an average of 71% of installed disk storage is actually being used for data storage, as reported in Exhibit III-44. However, as long as the user perceives this to be the case, storage requirements are certain to grow; therefore, this view is probably encouraged by IBM (and other vendors, for that matter).

- This perceived need for additional disk storage is confirmed by user projections of future on-line storage requirements. Installed storage is projected to more than double by the end of 1980 (an increase of 112%) and more than triple by 1984 (increase of 350%), as shown in Exhibit III-45.

  - Fifty-eight percent of respondents indicated new applications will necessitate the increase.

  - Only 7% is reportedly due to new timesharing applications.

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EXHIBIT III-43

MEDIUM RANGE USERS
ESTIMATE OF RELATIONSHIP OF DISK AND TAPE AS
A PERCENTAGE OF TOTAL STORAGE FOR 1980 AND 1984

STORAGE MEDIUM	1980 TOTAL STORAGE				1984 TOTAL STORAGE			
	HIGH (%)	LOW (%)	AVERAGE (%)	TOTAL NUMBER OF RESPONSES	HIGH (%)	LOW (%)	AVERAGE (%)	TOTAL NUMBER OF RESPONSES
TAPE STORAGE	100%	-	50%	47	100%	-	38%	47
DISK STORAGE	100	-	50	47	100	15%	62	47

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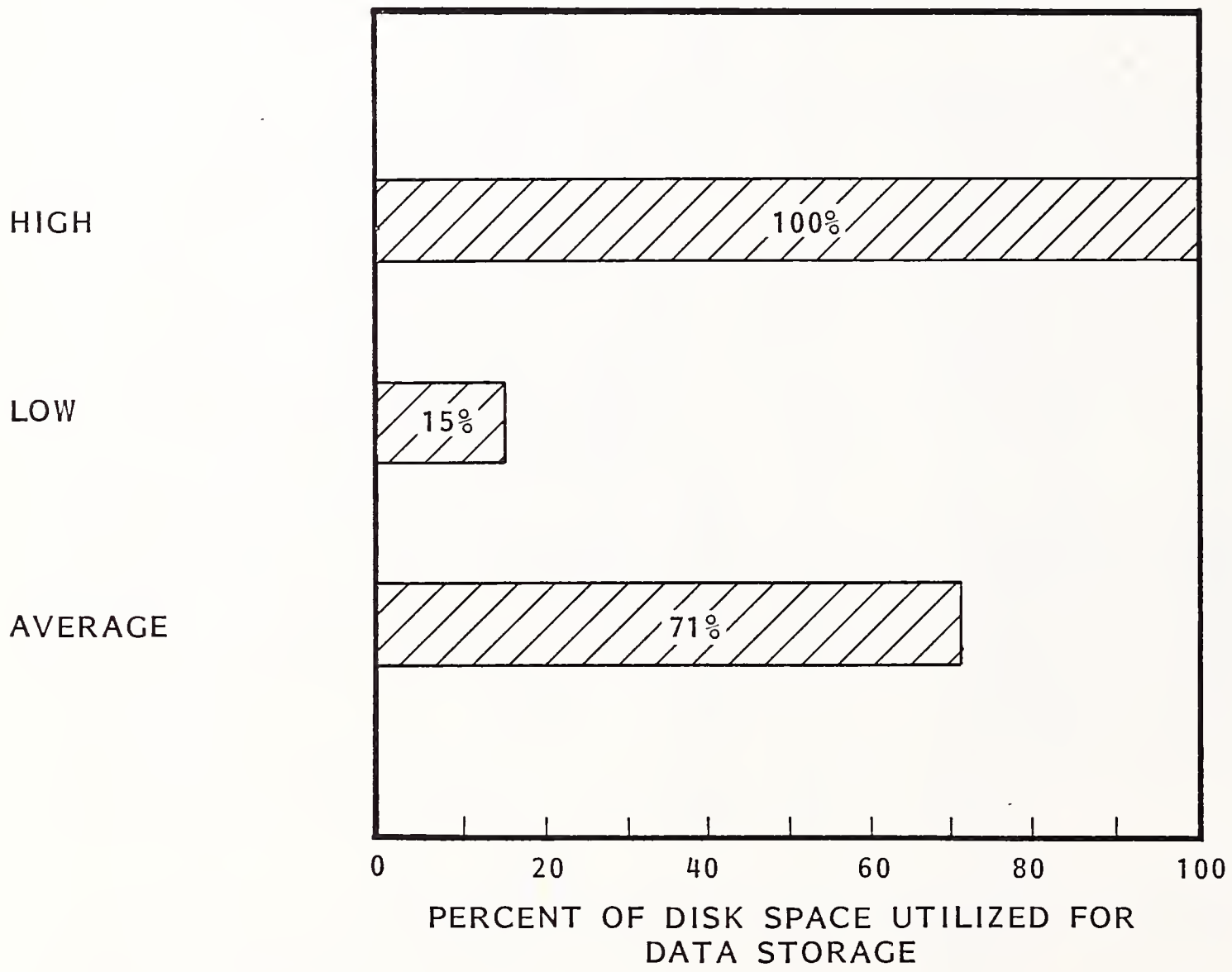
EXHIBIT III-44

MEDIUM RANGE USERS
ESTIMATE OF ACTUAL DISK SPACE AVAILABLE
THAT IS UTILIZED FOR DATA STORAGE



NUMBER OF RESPONSES = 47

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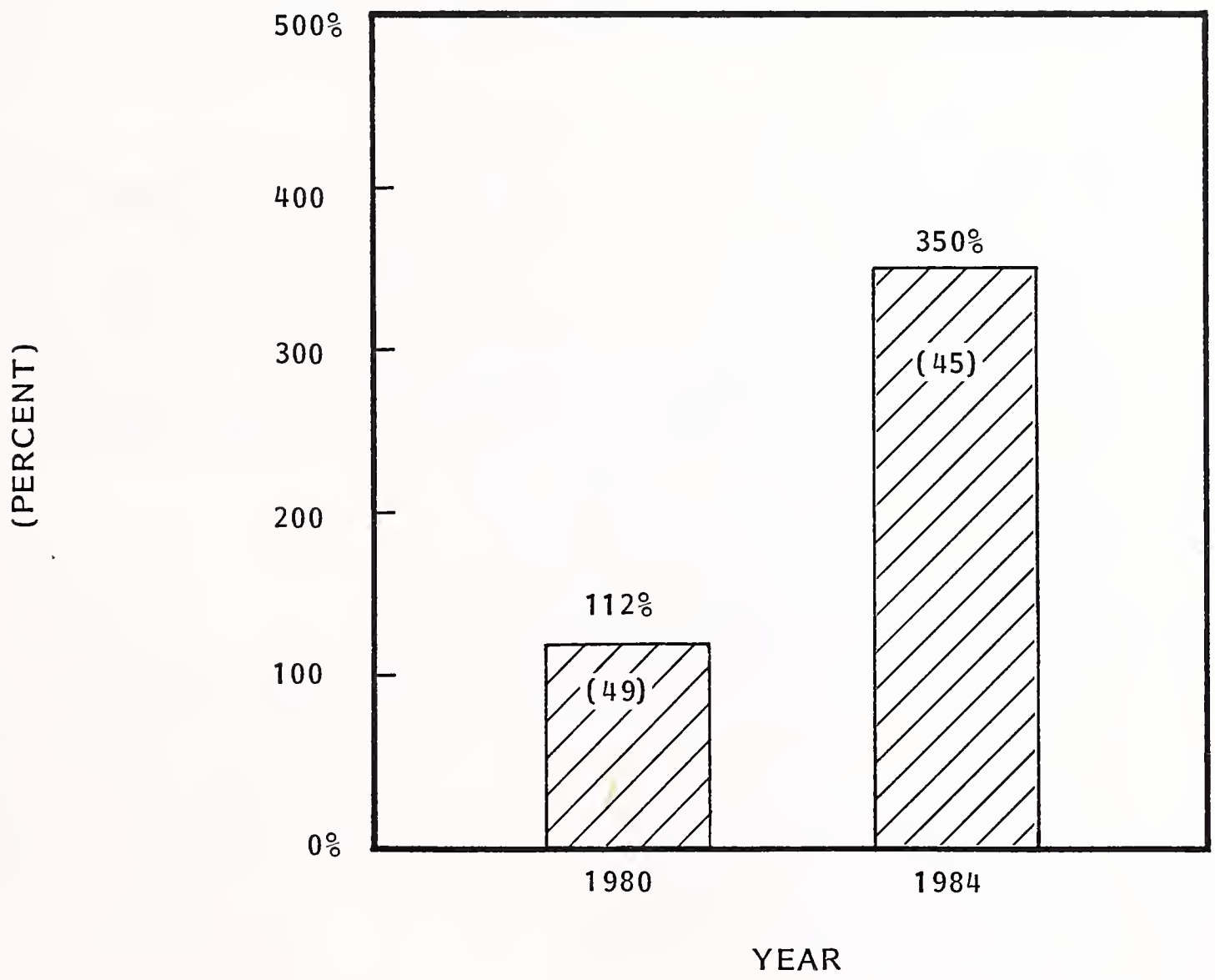
EXHIBIT III-45

MEDIUM RANGE USERS
PROJECTED AVERAGE INCREASE OF ON-LINE
STORAGE FOR YEAR END 1980 AND 1984



( ) = NUMBER OF RESPONDENTS

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- The remaining 35% is the result of normal growth and "other" reasons.

- An attempt was made to determine how users were changing their data structures. The results were inconclusive. Terminology was a primary problem. Evidently most medium range users did not understand the IBM jargon of "data sets" and still preferred to think of "files." The problem of terminology between various IBM customer groups, based on software terminology, should not be minimized - it can generate a positive or negative reaction in a sales call.

- Most users have installed backup and recovery procedures (86%), have used these procedures (74%) and are satisfied with their currently installed recovery system (90%), as shown in Exhibit III-46. It can be conjectured that medium range users are still "applications" and "file" oriented rather than "data base" oriented when backup and recovery becomes more important and complicated.

6. NEW TECHNOLOGY AND STANDARDS

- When asked about software and firmware tools they would like to see developed for storage management, most medium range users fell into one of two categories: those who did not know or care to comment, or those who felt there were plenty of tools already available. Those making specific recommendations most frequently asked for backup and recovery systems (evidently the minority of users not already satisfied). Other specific comments including:

  - "IBM should copy what Burroughs did in the 1950s."

  - "A single level storage system like the IBM System/38."

  - "New lower priced mass storage for medium sized installation." (This is a modest confirmation of the earlier conclusions reached concerning the mass storage utility.)

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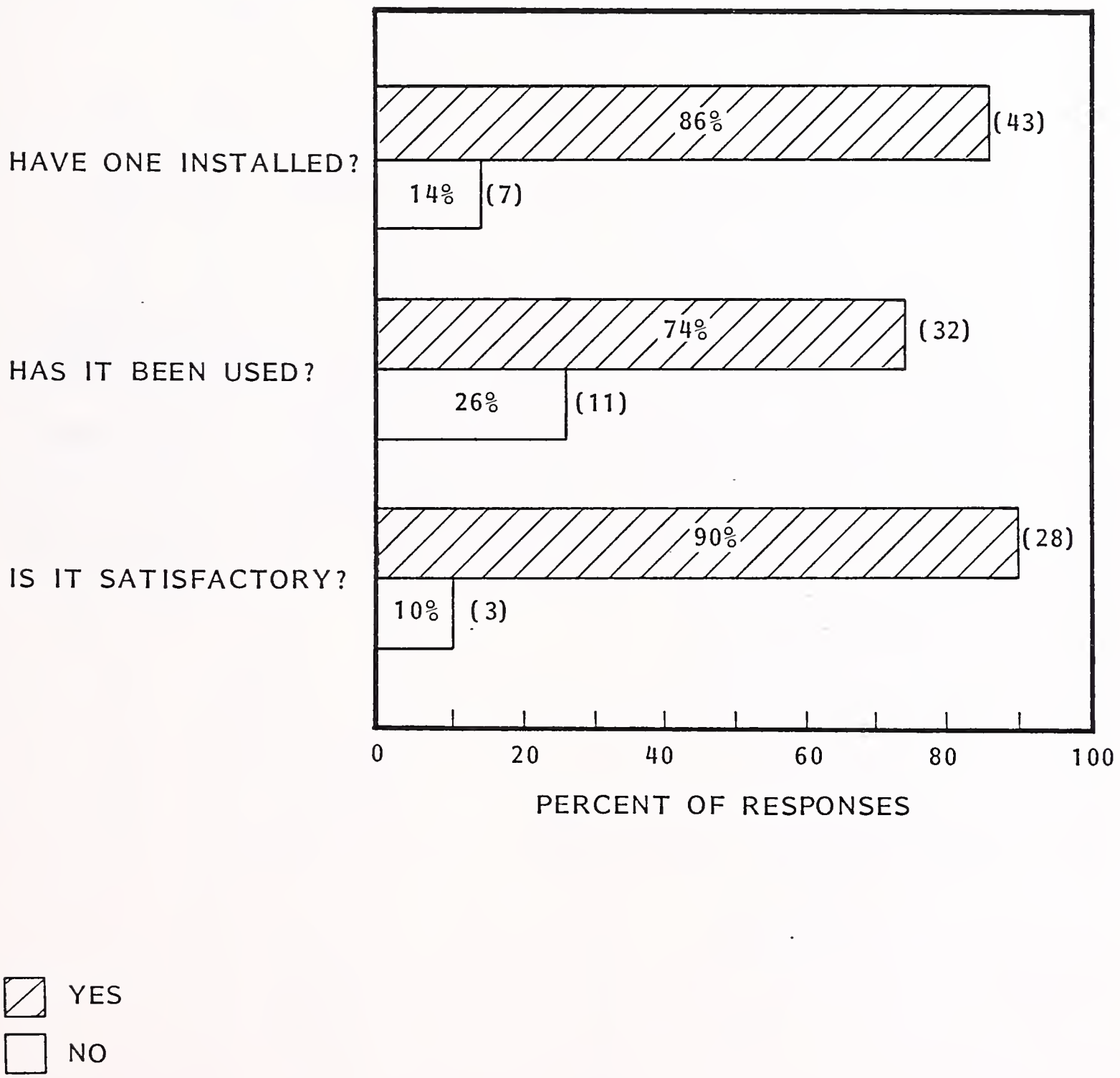
EXHIBIT III-46

MEDIUM RANGE USERS
STATUS OF BACKUP RECOVERY SYSTEM FOR
ON-LINE STORAGE



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- "DBMS software should be put into hardware and/or firmware."

- In general, medium range users did not seem to be well informed or especially anxious about these developments or problems. However, one phenomenon is worth mentioning: the users who would not consider vendors other than IBM, had the least knowledge or interest in what IBM might do. Those with PC installed equipment seemed to have more opinions of what IBM might do.

- The majority (22 of 40 respondents) would expect the mainframe vendor to supply storage management support, and most (29 of 32 respondents) would expect IBM to supply such tools (once the magic word IBM was mentioned).

- When asked about the probability of specific IBM technological development, users seldom rejected the possibility that IBM might announce the specified technology within the next two years, as illustrated in Exhibit III-47. If the "don't knows" are assumed to be those not familiar with the new technology, the responses in favor of IBM announcing are surprisingly similar. Of those answering either "yes" or "no" (and presumably familiar with the specific technology) the affirmative is favored by the following percentages:

- Bubble Memories:	63%
- Charge coupled devices:	53%
- Flat plane gas discharge CRTs:	80%
- Hardware DBMS:	73%
- Thin film tape heads:	79%

- This represents a rather surprising vote of confidence in IBM remaining abreast of technology. Traditionally, even IBM customers recognized that there was a tendency on the part of IBM to trail the rest of the industry in

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EXHIBIT III-47

MEDIUM RANGE USERS

PROJECTIONS OF NEW IBM TECHNOLOGIES IN THE

1980-1981 TIMEFRAME

TECHNOLOGY ADVANCE	YES		NO		DON'T KNOW		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
BUBBLE MEMORIES	26	52%	15	30%	9	18%	50
CHARGE COUPLED DEVICES	9	18	8	16	33	66	50
FLAT PLANE GAS DISCHARGE CRTs	20	40	5	10	25	50	50
HARDWARE DBMS	29	58	11	22	10	20	50
THIN FILM HEADS FOR TAPES	19	38	5	10	26	52	50

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technology developments. It is probable that medium range users have been duly impressed by the 4300 series announcement.

- There seems to be a "knee jerk" reaction that standardization is "good" and that both the industry and users will benefit from architectural standardization (Exhibit III-48). Considering the lack of knowledge about new technologies demonstrated in previous questions (as represented by "don't knows"), the certainty about architectural standardization is quite dramatic - only 5% of the medium range users stated that they didn't know whether it was good or bad.

- The question of architectural standardization is much more complex than any specific hardware (or software) product. Whether it will be "good" or "bad" is not at all clear from anyone's point of view (user or vendor). The fact that medium range users react favorably (presumably with little detailed knowledge) points to the need for better education in an area which has traditionally been left to large scale CPU vendors and the federal government. (Also, it points to the need for more detailed research into end user attitudes in this area.)

7. SOFTWARE

- Medium range CPU users demonstrate clearly that they are aware their current systems software is not (or will not be) adequate for very long.

  - Eighty-two percent of the medium range users indicated they planned to change or add systems software.

  - This corresponds to less than 75% for large scale users and less than 50% for small range users.

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EXHIBIT III-48

MEDIUM RANGE USERS

REACTION TO THE CONCEPT OF INDUSTRY

ARCHITECTURAL STANDARDIZATION

QUESTION	YES		NO		DON'T KNOW		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
WILL THE INDUSTRY BENEFIT?	30	60%	17	34%	3	6%	50
WILL THE USER BENEFIT?	36	72	12	24	2	4	50

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- Not surprisingly, a high percentage of medium range users will be implementing the new software on equipment other than that currently installed. Seventy-three percent plan to install software on new equipment, compared to only 39% of the large scale users.

- The source of systems software is similar for medium range and large scale users. While the mainframe vendors are the primary suppliers in both cases, 31% of the medium range users supplement their systems software with that provided by software vendors, and 29% of the large scale users do the same.

  - This is surprising, because it had been assumed that medium range users were under tighter IBM software control than were large scale users. (This general assumption was confirmed in the case of small range users, where only 3% used outside systems software vendors.)

  - Upon consideration, a possible explanation is as follows:

    . IBM's current data base and terminal support systems require enormous hardware resources.

    . Sales efforts designed to prompt up-grades get medium range users interested in such systems.

    . Those IBM medium range users who have resisted up-grading to large scale hardware systems have sought systems software more suitable for their mainframes.

  - While the above mid-range software opportunity was known to exist, the success of software vendors in penetrating this market is impressive. Perhaps it was merely a matter of the medium range users not having had a viable IBM alternative. Certainly, it can be assumed that the 4300 series is designed to provide medium range users a more convenient bridge to IBM's "mainstream" offerings.

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- The 4341 is pressing the low end of IBM's large scale systems (System/370 Model 158 and the 3031) in terms of performance. Price/performance demonstrates clearly that users should not concern themselves with the cost of processing power. The promise of even more processing power which would significantly overlap current large scale procesors has also been widely predicted for the 4300 series.

- Systems software performance enhancements (at a price) were also a major feature of the 4300 announcement.

- The large disk storage capacity (3370) and the new storage controller (3880) promise significant improvement in medium range systems users' ability to implement IBM data base systems in an effective manner.

- Thus, the medium range users' current plans to change systems software could reflect the success of IBM's 4300 series announcement in addressing an obvious software problem (from IBM's point of view). The degree of impact on competitive software vendors is not immediately known, but the market will unquestionably become much more competitive.

- When users were asked whether their current sources of system software would change, medium range users responded in a more affirmative manner (33% stated "yes") than did large scale users (15%) or small range users (17%). However, detailed analysis of how expenditures would change is inconclusive.

  - Users who felt expenditures for IBM software would increase, based their conclusion on the fact that IBM was unbundling, and VSE would "raise costs."

  - On the other hand, several users indicated they would buy non-IBM DBMS and that would increase expenditures from competitive software vendors.

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- It does not appear that medium range users have firm software plans, even though the next generation of hardware has been announced. The only firm conclusion seems to be the knowledge that there must be change. General statements, such as the following, are prevalent.

  - "We will be spending more with IBM."
  - "We are going to buy more from non-IBM sources."
  - "We are going to buy a DBMS, but we don't know whose."
  - "Software (systems) will cost more."

- At least 80% of medium range CPU applications software is developed internally. However, when users do purchase applications packages, they prefer non-IBM vendors (20 mentioned competitive software vendors, and only 7 mentioned IBM).

- Thirty-two percent of the medium range user respondents indicated their pattern of application software acquisition would change by 1981. Generally speaking, the pattern would be to increase the amount of internal development and purchase from independent software vendors. However, the decision to change does not indicate any specific plans, but rather a "feeling" that external sources will be used.

- Respondents were asked to comment on the status of their utilization of three types of utility software products.

  - Data Base Management Systems.
  - Storage Manager Software Packages.
  - Security Packages.

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These responses are presented in Exhibit III-49.

- Thirty-eight percent of the medium range users have Data Base Management Systems installed (or at least what they perceive to be DBMS). Of those who do not have a DBMS installed, 21 users state they are seriously considering installing some type of system and 10 state they will not install.

- Most users having DBMS installed do not intend to change. These users are equally split between IBM and other vendors. Seven users had installed IBM DL/I; 3 had TOTAL; 2 had IDMS, and ADABAS and Datacom each had one installation.

- Users planning to change are using what they consider to be obsolete IBM systems (DBOMP and IPICS). One user stated he was thinking of changing from TOTAL.

- An analysis of those users considering DBMS reveals the same general lack of specific plans associated with systems software and applications software. Indeed, it is probable that the medium range user's software plan responses solicited under the two previous areas reflect general plans in the data base area. In other words, the systems programming changes will be associated with the acquisition of a data base system, and the acquisition of external "applications software" which really translates into a DBMS system.

- Only 16% of medium range users (8 respondents) had installed a software package for storage management. The primary area of concern with such systems is that they will not be compatible with newly announced IBM systems software for the 4300 series (VSE).

- Fourteen respondents (28%) indicated they were seriously considering storage management facilities. These were primarily oriented toward the standard software support announced for the 4300.

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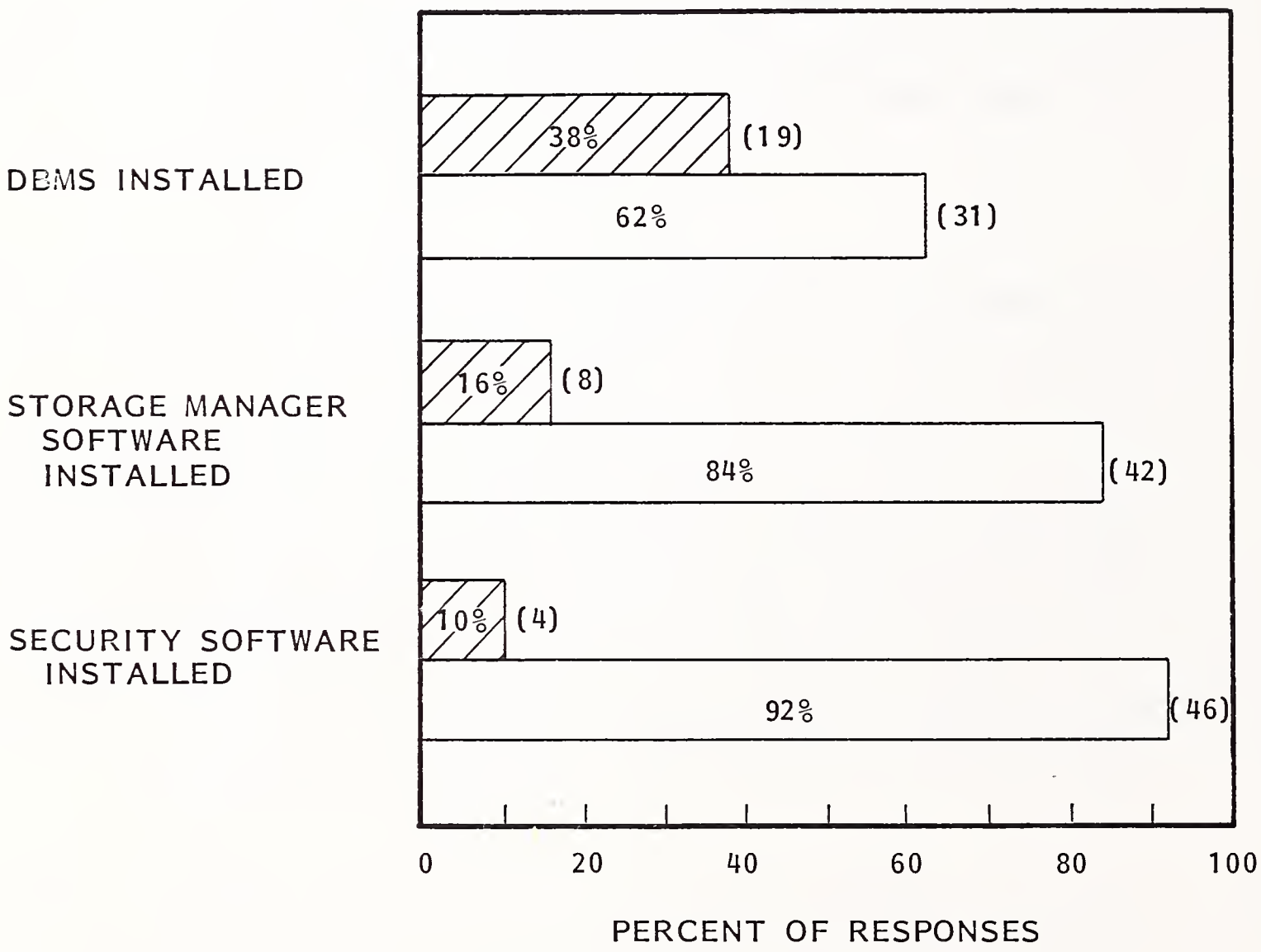
EXHIBIT III-49

MEDIUM RANGE USERS
STATUS OF UTILIZATION OF UTILITY SOFTWARE PACKAGES



NUMBER OF RESPONSES = 50

YES
NO

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- Despite the current academic arguments about security, only 8% (4 respondents) of medium range respondents have a security software package installed. Thirty respondents state they have no plans in this area, nine are "looking" at the problem, and six say they intend to install a system. For medium range users, security (except for simple password protection) does not seem to be a pressing requirement.

- A general question in the software area was whether the user would buy a compatible operating system from someone other than IBM. The answer was 28% affirmative (14 respondents) and 72% negative for medium range users, as shown in Exhibit III-50. This is not too surprising since nine users asked for improved software from plug compatible IBM vendors as a means of enhancing their product lines (reported earlier in this section).

- Medium range users are restless about software support at all levels. They are reasonably receptive to change, but they do not have specific plans to do very much except rely upon IBM.

8. MAINTENANCE

- All medium range customers were familiar with IBM systems support centers. Forty-eight percent had direct exposure to their services, as shown in Exhibit III-51. Considering the nature of the recent change, user acceptance has been exceptional. For those who have actually used the centers:

  - Seven consider the new service to be outstanding. They feel they have ready access to experts on their problems. (One respondent said it is the "best thing they have ever done.")

  - Eleven users stated that the new service was at least as good as (or better than) what had previously existed.

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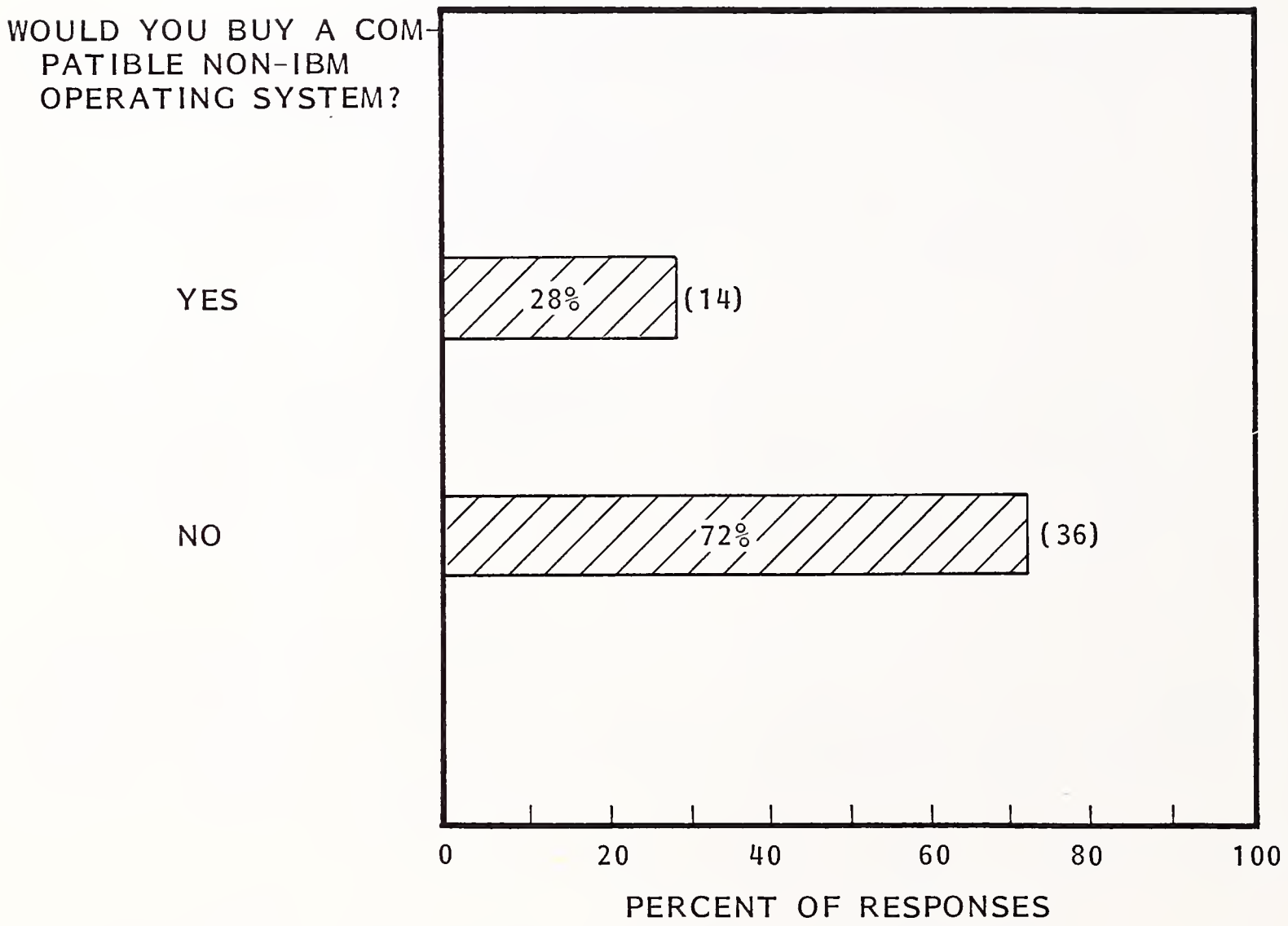
EXHIBIT III-50

MEDIUM RANGE USERS
ACCEPTANCE OF COMPATIBLE NON-IBM
OPERATING SYSTEMS



NUMBER OF RESPONSES = 50

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EXHIBIT III-51

MEDIUM RANGE USERS
RESPONDENT USERS' EXPOSURE TO
IBM SYSTEM SUPPORT CENTERS

EXPOSURE	YES		NO		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
KNOWLEDGE OF IBM SYSTEM SUPPORT CENTERS?	50	100%	-	-	50
EXPERIENCE WITH SYSTEM SUPPORT CENTERS?	26	52	24	48%	50

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- Four were negative and stated the new service was poor. The primary reason seemed to be the impersonal nature of solving problems on the telephone.

- Five users said they had not had time to evaluate the service, but did not have specific problems to report.

- Fifty-four percent of medium range respondents have a mixed IBM and plug compatible environment. Only 31% would consider contracting all of their maintenance to a PC supplier. This increased to only 38% when the assumption was made that IBM would maintain its own equipment on a subcontract basis, as reported in Exhibit III-52.

- Considering the substantial number of users who were critical of PC maintenance and service, it is somewhat surprising that 31% would even consider a total maintenance contract. One possible explanation is that a full service contract would warrant local maintenance services.

- When asked about the possibility of remote diagnostics proposed for the 4300 series, medium range users were generally very receptive - in fact, even enthusiastic.

  - Twenty-nine respondents expressed the feeling that this would improve IBM's maintenance service.

  - Only three felt apprehensive about the potential impact upon their operations.

  - The other 18 were neutral on the subject. They either had no opinion or felt service would remain the same.

- The acceptance of remote diagnostics is a good example of the trust medium range users have in IBM service and maintenance. Remember the medium range user's desire for local service from PC vendors and then consider the

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EXHIBIT III-52

MEDIUM RANGE USERS

ATTITUDES TOWARD SOURCE OF MAINTENANCE

SOURCE OF MAINTENANCE	YES		NO		MAYBE		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
MIXED IBM AND PC OPERATING TODAY	27	54%	23	46%	-	-	50
CONSIDER CONTRACTING ALL MAINTENANCE TO PC SUPPLIER	9	31	17	59	3	10%	29
CONSIDER CONTRACTING TO PC SUPPLIER IF IBM A SUBCONTRACTOR	11	38	14	48	4	14	29

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positive responses when IBM "promises" centralized service centers and remote diagnostics. It will obviously be better or IBM would not be making the change.

- How far will the user's cooperation go as far as maintenance is concerned? Exhibit III-53 examines the responses to this question.

  - Ninety-eight percent stated they would be willing to either run diagnostics themselves or assist the vendor in doing so.

  - Seventy-five percent would be willing to replace boards either independently or in cooperation with the vendor.

  - However, only 36% would be willing to help in transporting equipment to a central repair facility.

  - Not too surprisingly, only 14% would be willing to assist in component level repair.

  - It is possible to speculate that these last two percentages would shift significantly in the event that IBM ever decides that user cooperation would be beneficial to all concerned.

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EXHIBIT III-53

MEDIUM RANGE USERS

WILLINGNESS TO PARTICIPATE IN MAINTENANCE TASKS

WOULD USER BE WILLING TO:	DO IT YOURSELF?		COOPERATE WITH VENDOR		NOT AT ALL		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
RUN DIAGNOSTICS?	25	51%	23	47%	1	2%	49
REPLACE BOARDS?	19	40	17	35	12	25	48
DELIVER/PICK UP TO CENTRAL REPAIR DEPOT?	7	15	10	21	31	64	48
COMPONENT LEVEL REPAIR?	3	6	4	8	42	86	49

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C. SMALL RANGE USERS

- Small range users were defined in the survey as IBM GSD (General Systems Division) users; i.e., Series 1, System/34, or where the main installed IBM computing system had the power of less than an IBM/System 370 Model 125.

1. CURRENT INSTALLED AND ON ORDER POSITION

- In general, all of the small range users had been exposed to the System/38.

  - Significantly, only 10% (five users) had placed orders for System/38. (See Appendix A, Exhibit A-1: CPUs Installed Or On Order By Respondents.) Three of the five were highly dissatisfied with the change from scheduled delivery dates to unknown delivery dates.

- The responding small range users also revealed:

  - A large number (20 of the 62 computers installed) were IBM 360s, most of which were from third party firms.

  - Twelve of the 50 users were moving into the IBM 43XX fold.

  - Only two users had a non-IBM computer in addition to the IBM mainframe.

  - A majority of the users (60%) were planning to change computers and had ordered IBM.

  - Only one user was considering other than IBM.

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- Because of maintenance and other service requirements, the users did not want to mix vendors, except for terminals, and would either order directly from IBM or through third party firms handling used IBM equipment.

- The state of the disk market is almost directly correlative to the computer market. The non-IBM market penetration amounts to approximately 2%. (See Appendix A, Exhibit A-2: Disk Drives Installed Or On Order By Respondents.)

  - This apparently dismal picture should not be over emphasized. It portrays a marketing penetration in spite of lack of sales coverage for small range users.

  - There is a limited amount of PC equipment available for the System/3-X user.

  - Also, there is a lack of sophistication at the small range user level that causes a great reliance on IBM as "the safe place to be."

- The status of the tape and printer market is somewhat more encouraging. It shows almost a 10% penetration. (See Appendix A, Exhibit A-3: Tapes Installed Or On Order By Respondents; and Exhibit A-4: Printer Equipment Installed Or On Order By Respondents.)

  - The vast majority of this equipment was provided by third party firms and was not directly procured by the user from the manufacturer. This arrangement appeared to be acceptable.

- The terminal installed base (see Appendix A, Exhibit A-5: Terminals Installed Or On Order By Respondents) shows a 31% penetration and is the one really bright spot for PC vendors in the small range user market.

  - However, while this area is growing at a faster rate (42%) than the medium range or large scale CPU users area, the on-order position shows PC vendors losing ground.

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- Again, the on-order position should be viewed as relatively unimportant as far as PC vendors are concerned.

  - The users perceive PC houses as being able to deliver faster than IBM.

  - As opposed to the medium range and large scale user, the small range user is normally not blessed with a planning department.

  - The data processing manager is seldom advised of the company's long or short range plans.

  - Workload increases, and their timing is reflected in the relative dominant on-order position of the user.

- In summary, the market to small range users, except for terminals, has not been a fertile field for PC vendors. This can be traced to:

  - A lack of coverage; i.e., with limited manpower, and more profitable prospects.

  - The user's dependence on one vendor for a total system.

  - The user's lack of time or staff for planning and evaluation.

  - A lack of adequate devices for smaller IBM systems.

2. TIMESHARING USAGE AND PLANS

- Even though 37 users have terminals installed (79%) only 5 users (10%) have timesharing as an active application, as shown in Exhibit III-54.

- While one timesharing user reported as high as 10 active users at one time (shown in Exhibit III-55), the average was 4.4.

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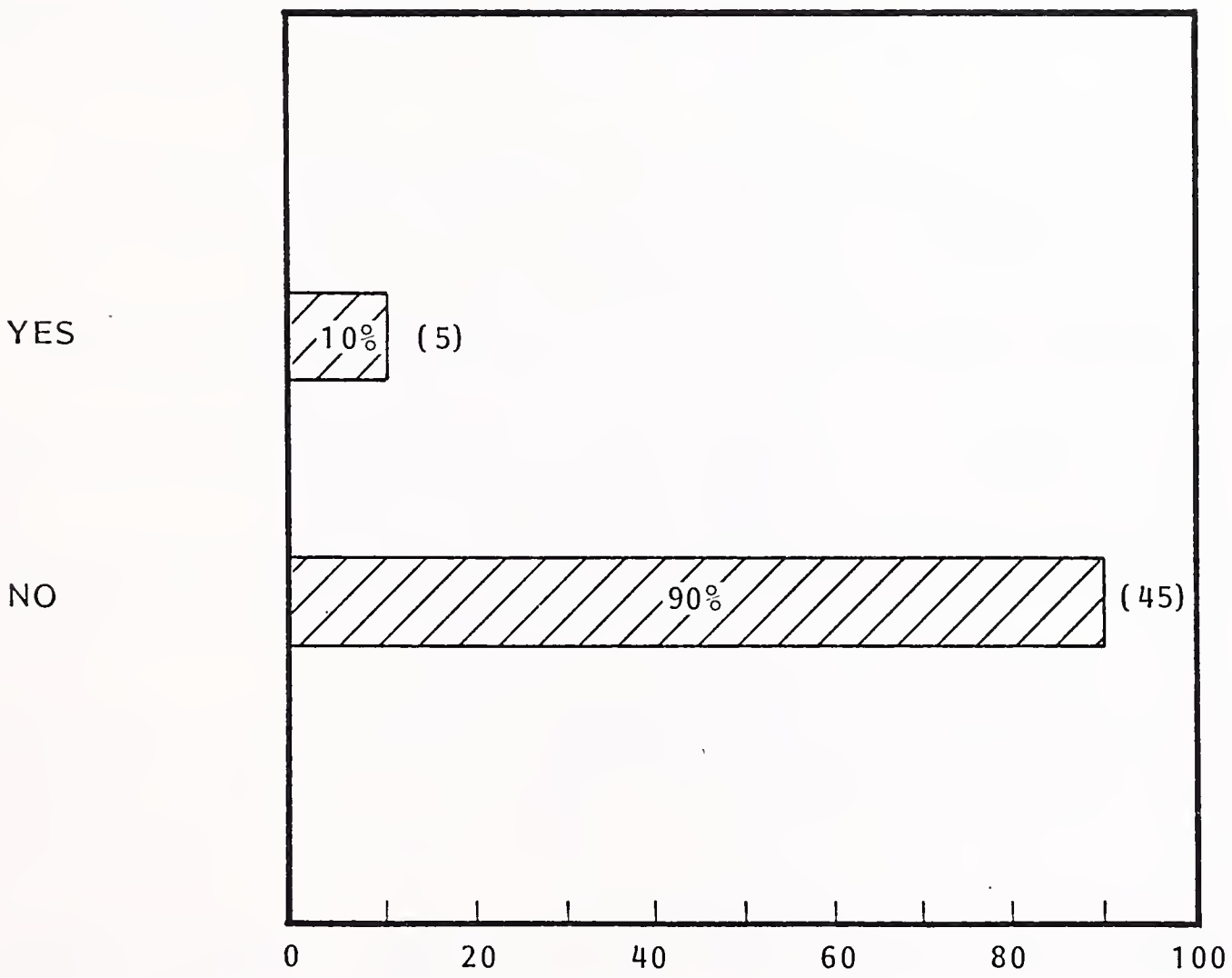
EXHIBIT III-54

SMALL RANGE USERS
PERCENT OF RESPONDENT USERS WITH
IN-HOUSE TIMESHARING



NUMBER OF RESPONSES = 50

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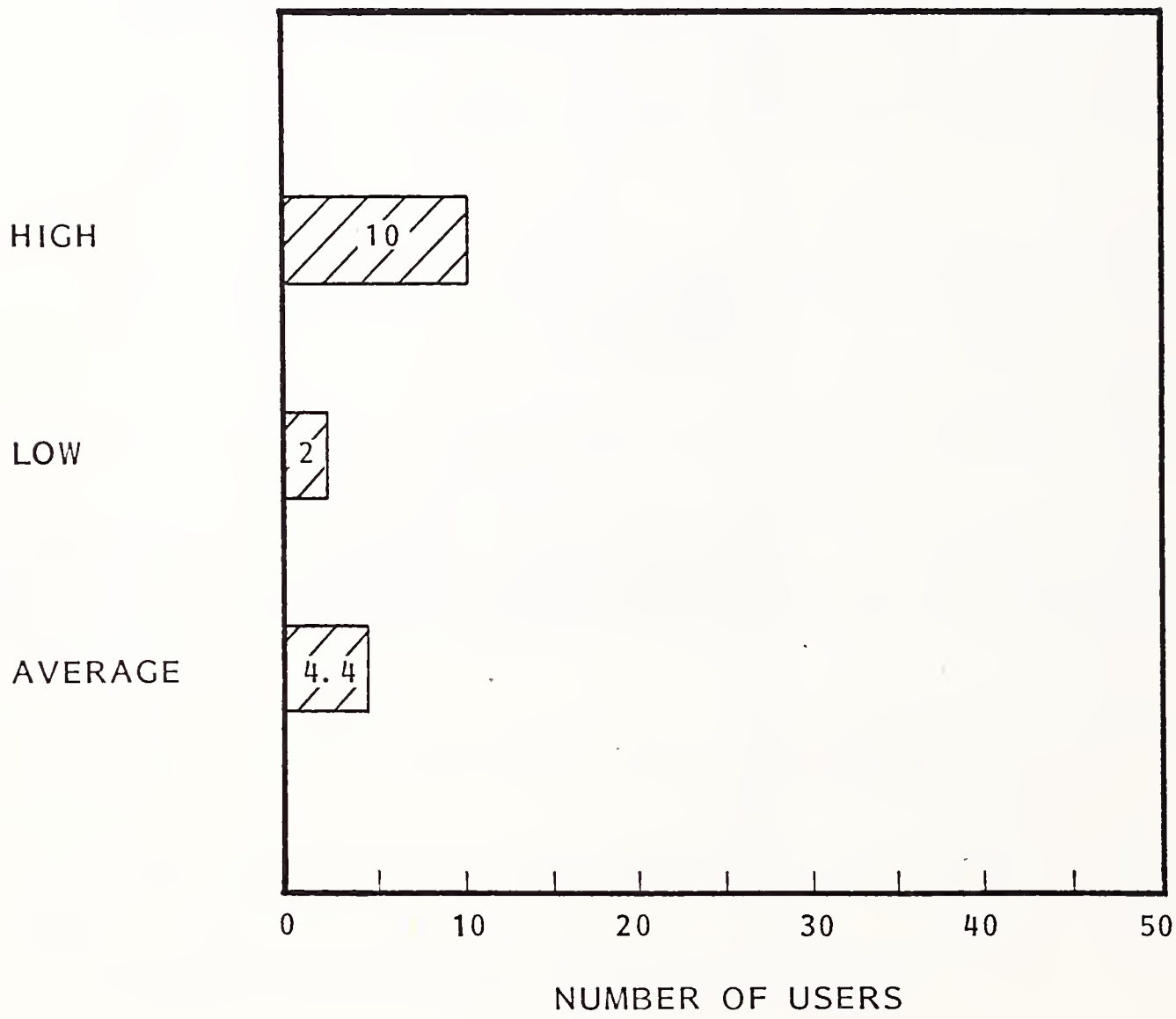
EXHIBIT III-55

SMALL RANGE USERS
AVERAGE NUMBER OF TIMESHARING USERS
ON-LINE AT ANY ONE TIME



NUMBER OF RESPONSES = 50

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- This would indicate that approximately 7% of the active terminals attached to the users' systems were used for timesharing.

- It can be concluded that small range user timesharing does not represent a significant market that will carry along any major increases in storage or terminals.

- The small range user's utilization of timesharing is limited by:

  - The small computers installed cannot support timesharing (especially in a mixed environment with batch or interactive processing).

  - The availability of software to run timesharing on small IBM equipment.

3. PURCHASE VERSUS LEASE

- As recounted in Exhibit III-56, 32 of the 50 respondents (64%) preferred to purchase equipment.

- When asked if they intended to change their method of acquisition from purchase to lease, 22% of the 32 purchase oriented users replied in the affirmative (reported in Exhibit III-57).

- This means that the purchase versus lease market among the small range users will split approximately 50/50.

- Users who expressed opinions on this change indicated that:

  - The market, with its many announcements, was too fluid to make long term commitments.

  - Reasonable additional advances could be expected over the next two to three years.

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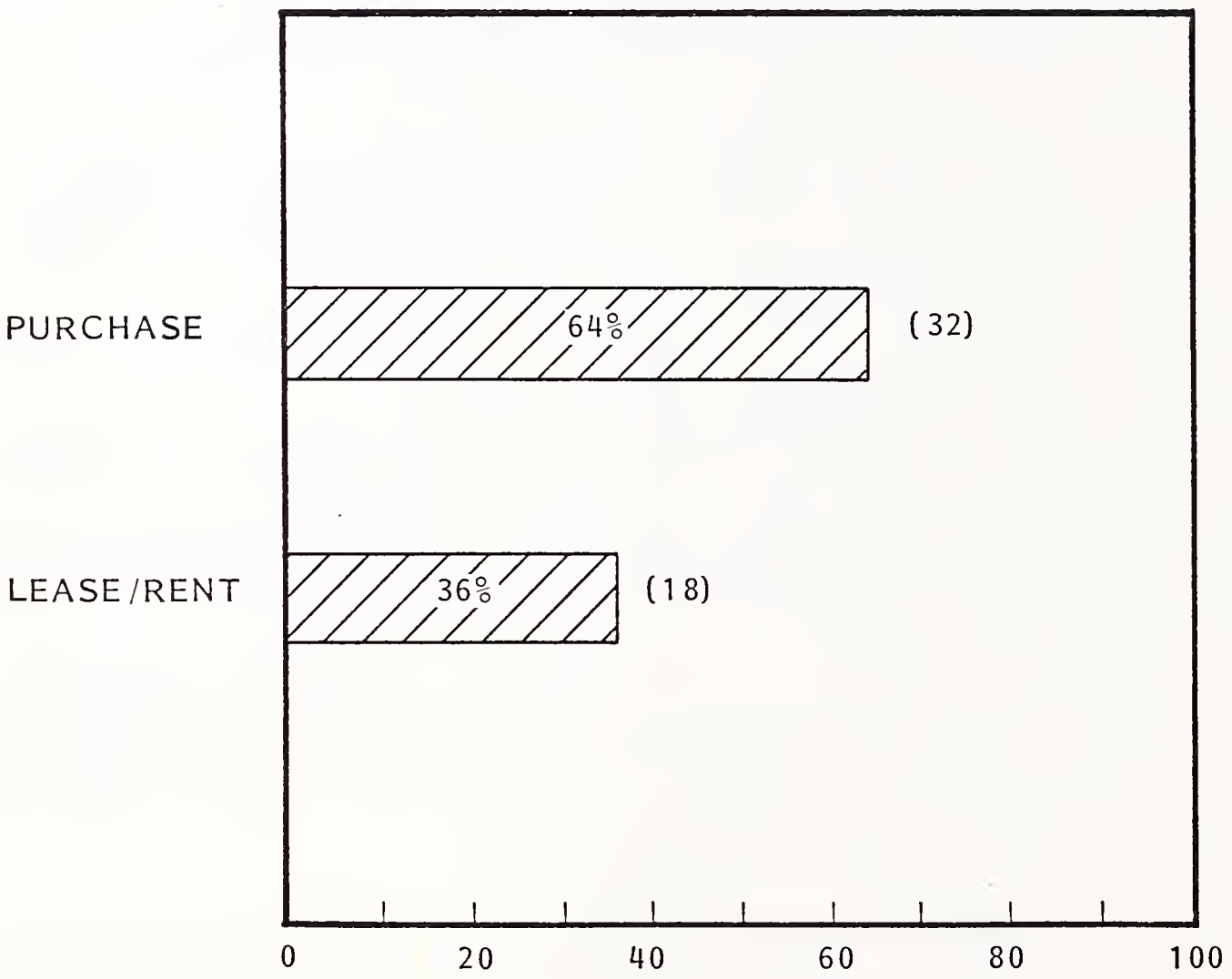
EXHIBIT III-56

SMALL RANGE USERS
PRESENT METHOD
OF EQUIPMENT ACQUISITION



NUMBER OF RESPONSES = 50

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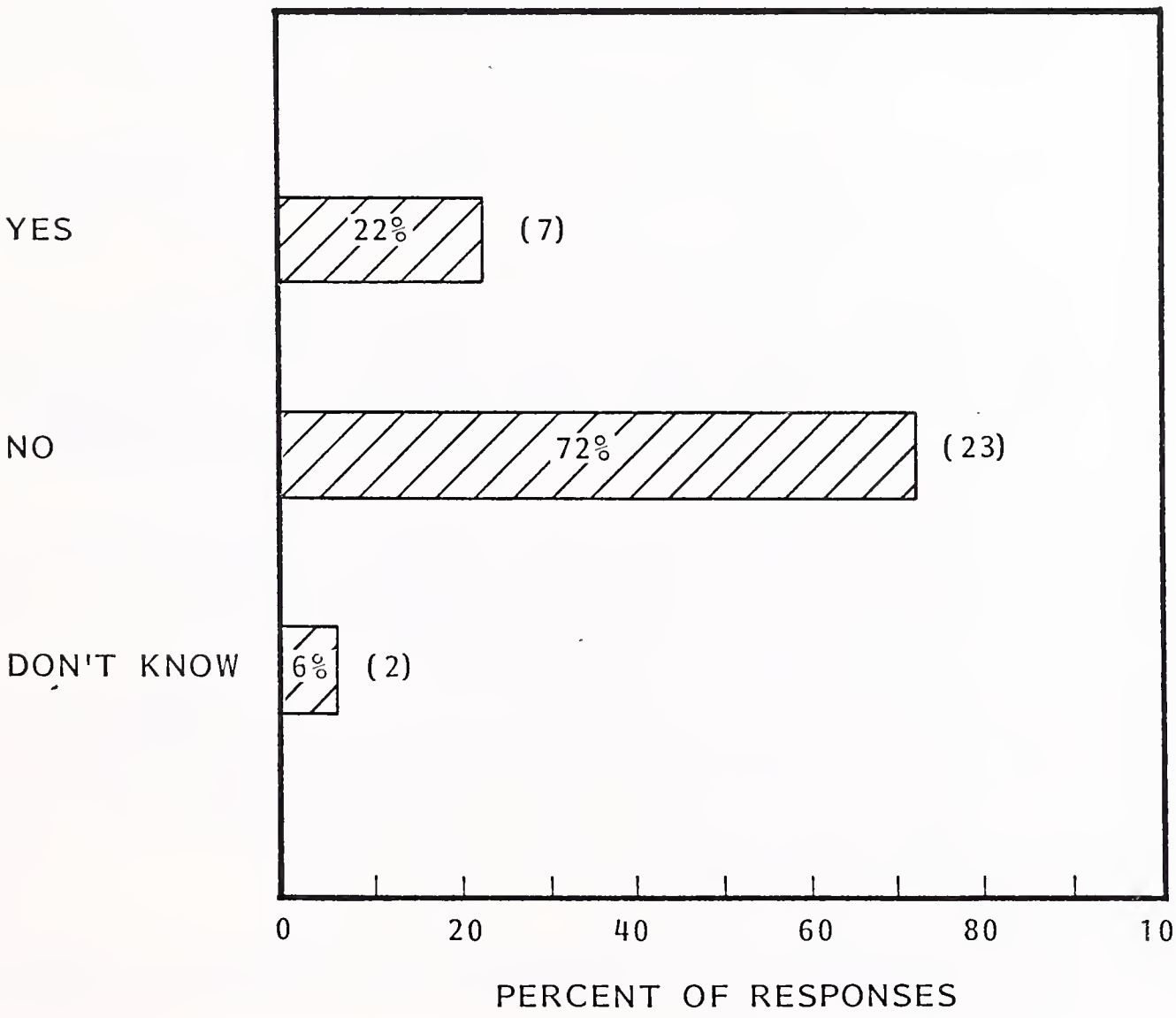
EXHIBIT III-57

SMALL RANGE USERS
PERCEIVED CHANGE OF PURCHASE TO LEASE AS A METHOD OF EQUIPMENT ACQUISITION



NUMBER OF RESPONSES = 32

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- Technology was moving so rapidly that better devices may be forthcoming.

- As the new equipment begins to be shipped, better prices could be expected from third party companies on IBM/System 370s.

- Like the medium range and large scale users, the small range users have confirmed the market shift from purchase to lease which has had its revenue impact on all the vendors.

4. USER REACTIONS TO PC/PCM EQUIPMENT

- Considering the size, industry, and geographic distribution of the small range user sample, a surprisingly large number of those interviewed had been exposed to plug compatible products, as shown in Exhibit III-58.

  - While very few had PC equipment actually installed (except for terminals), their knowledge was derived from previous work experience or from their local peer group.

  - Some of these users had procured PC equipment which, for a variety of reasons, was no longer installed (the principal reason being reliability and maintenance).

- The main resistence to PC/PCM proposals and offerings were expressed as:

  - "Do not have the time or staff to analyze equipment offered."

  - "Are in a remote location and service is "X" miles further than IBM's."

  - "Can't afford the staff to manage a mixed shop."

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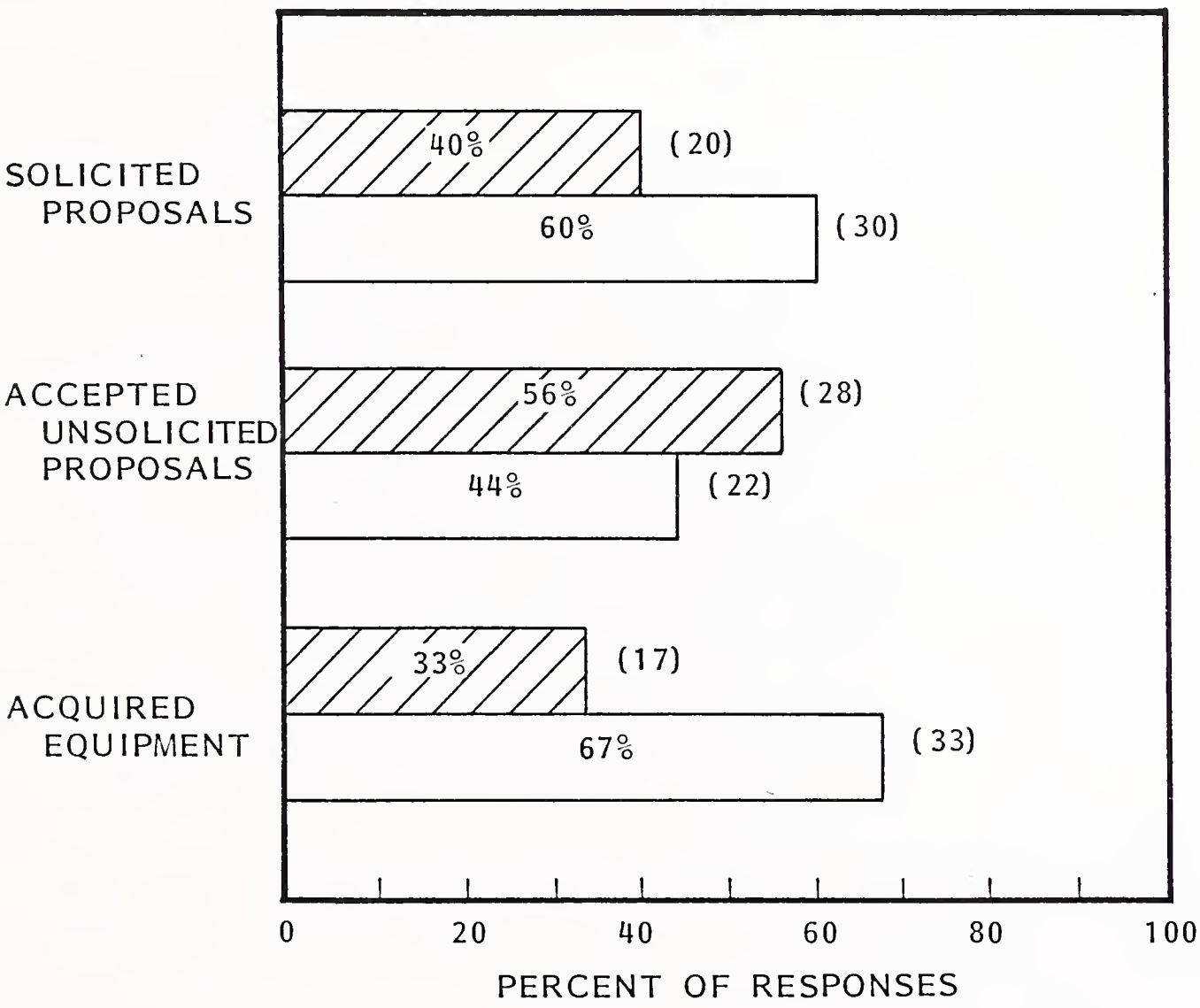
EXHIBIT III-58

SMALL RANGE USERS
ACTIONS REGARDING ACQUISITION OF PC/PCM EQUIPMENT



NUMBER OF RESPONSES = 50

YES
NO

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- While the small range user profile correlates closely with the other classes of users as it relates to price savings required, it seems to run contrary to the past patterns of sensitivity to savings in the 25% range.

  - Of the 50 users surveyed, only 26% indicated a willingness to "look at it" if a savings of 30% or less were possible. Exhibit III-59 illustrates this point.

  - A rather large 38% refused to be interested at any level of cost savings, citing performance, maintenance, and needed features as more important than cost reduction.

  - Summing the "would not buys," the "don't knows," and the "no specific levels," a total of 68% of those surveyed would be classified as a hard sell group.

- Amazingly, as can be seen in Exhibit III-60, 58% of the small range user group would acquire products employing technology not offered by IBM.

  - This answer is a surprise considering their propensity to deal with one vendor, and IBM in particular.

  - Perhaps it can be explained that very few have been offered new technologies and hence have never faced this decision.

- Users were asked "Why, in their opinion, could PC/PCM vendors sell compatible products for less than IBM?"

  - Less overhead due to company size - 21%.

  - Less maintenance and support - 18%.

  - Less R&D - 15%.

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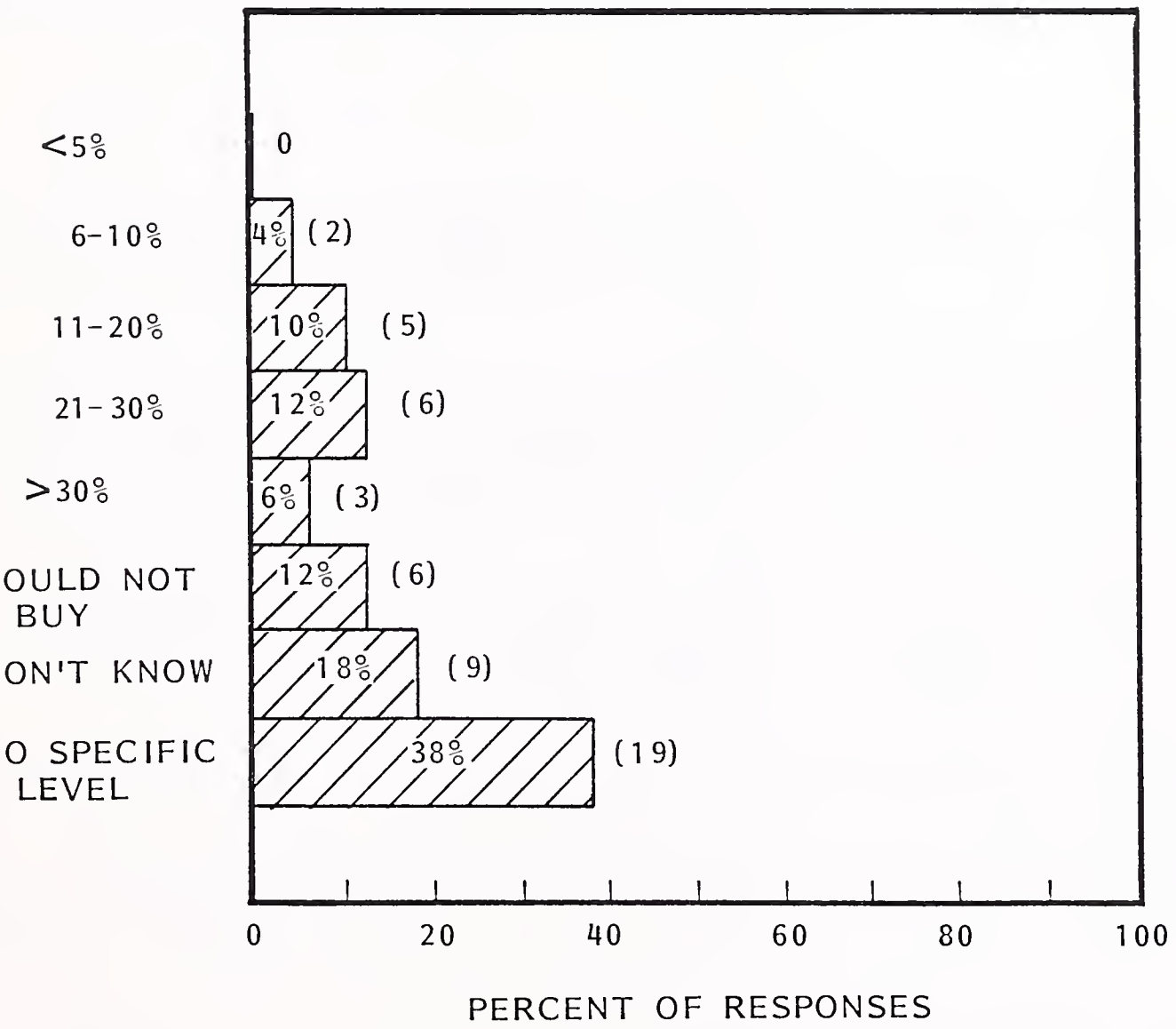
EXHIBIT III-59

SMALL RANGE USERS
PRICE SAVINGS LEVELS REQUIRED
TO PURCHASE PC/PCM EQUIPMENT



NUMBER OF RESPONSES = 50

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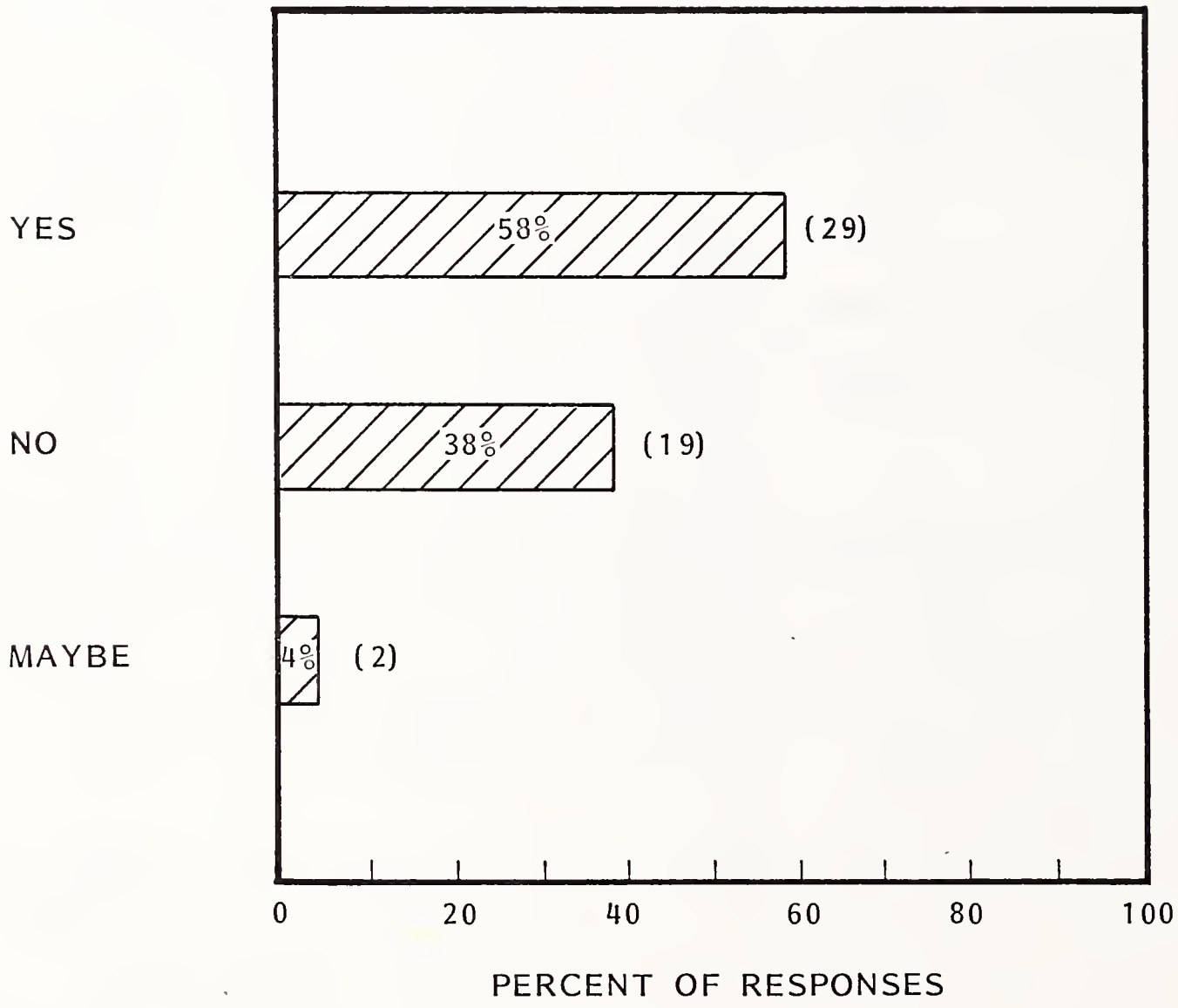
EXHIBIT III-60

SMALL RANGE USERS
RESPONDENT USERS' WILLINGNESS TO ACCEPT
NEW NON-IBM TECHNOLOGY PRODUCTS



NUMBER OF RESPONSES = 50

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- Less sales costs required to sell product - 15%.

- Less education for user and employees - 12%.

- New technologies - 9%.

- Lower profit margins - 9%.

- Pay people less - 2%.

- Based on these responses, one could conclude that PC/PCMs are still viewed as "copy houses" and offer very little, other than price savings.

- The small range user did not feel that a broader product line was important as a method of making the product more attractive - even for PCMs, as reported in Exhibit III-61.

  - Thirty-four percent of the respondents felt that PCMs should offer peripherals and software, in addition to mainframes.

- The lack of enthusiasm for expanded lines was further confirmed when users were asked what "extras" the PC/PCMs could offer. The responses showed very little specifics, except for DBMS as a useable tool, along with RPG II and RPG III. Small range users tended to not want to learn COBOL.

  - General comments, along with "don't know," included; quieter, faster printer, more disk storage per spindle, etc.

- When asked what vendors offered a viable alternative, the users mentioned the better known companies; i.e., Amdahl and Itel (who produce equipment out of their class) along with Memorex (terminals), Telex, Courier, and Lear Sieglar.

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EXHIBIT III-61

SMALL RANGE USERS

RESPONDENT USERS' PERCEPTION OF PC/PCM VENDORS' OFFERINGS

OF EXPANDED PRODUCT LINES

PLUG COMPATIBLE VENDOR OFFER	IMPORTANT		SOMEWHAT IMPORTANT		NOT IMPORTANT		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
PERIPHERALS ONLY	9	18%	3	6%	37	76%	49
MAINFRAME ONLY	3	6	4	8	42	86	49
MAINFRAME/ PERIPHERALS	10	20	2	4	37	76	49
ALL ABOVE PLUS SOFTWARE	17	34	4	8	29	58	50

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- The responses tended to confirm that their knowledge of PC/PCMs was limited to advertised/published companies and those terminal companies which have penetrated the small user market.

- Over one-third of the user's believed that Japanese vendors would be a possible contender in the computer/peripheral industry (depicted in Exhibit III-62), but there was no general agreement as to which areas the Japanese would enter.

  - The users did not believe that the Japanese could be successful in the medium to high end mainframe market due to software requirements. Hence, by default, they felt that they could best apply their electronic skills to the small to low medium range CPU market along with peripherals.

5. STORAGE REQUIREMENTS

- The small users' concept of "mass storage utility" revolves around their shop experience.

  - Thirty of the respondents were disk only operations and did not have the tape handling problems associated with the medium and high range users.

  - Yet, as portrayed in Exhibit III-63, 34% of the users viewed this as a fundamental element of a totally on-line storage system. Either they did not understand the question or have been somewhat exposed to a modified mass storage concept via the System/38 with fixed disks requiring tape backup.

- Tape, as a storage media, varied widely across the small range users, as analyzed in Exhibit III-64.

  - With over half the shops as disk only, the tapes were used mainly for program libraries and long-term storage.

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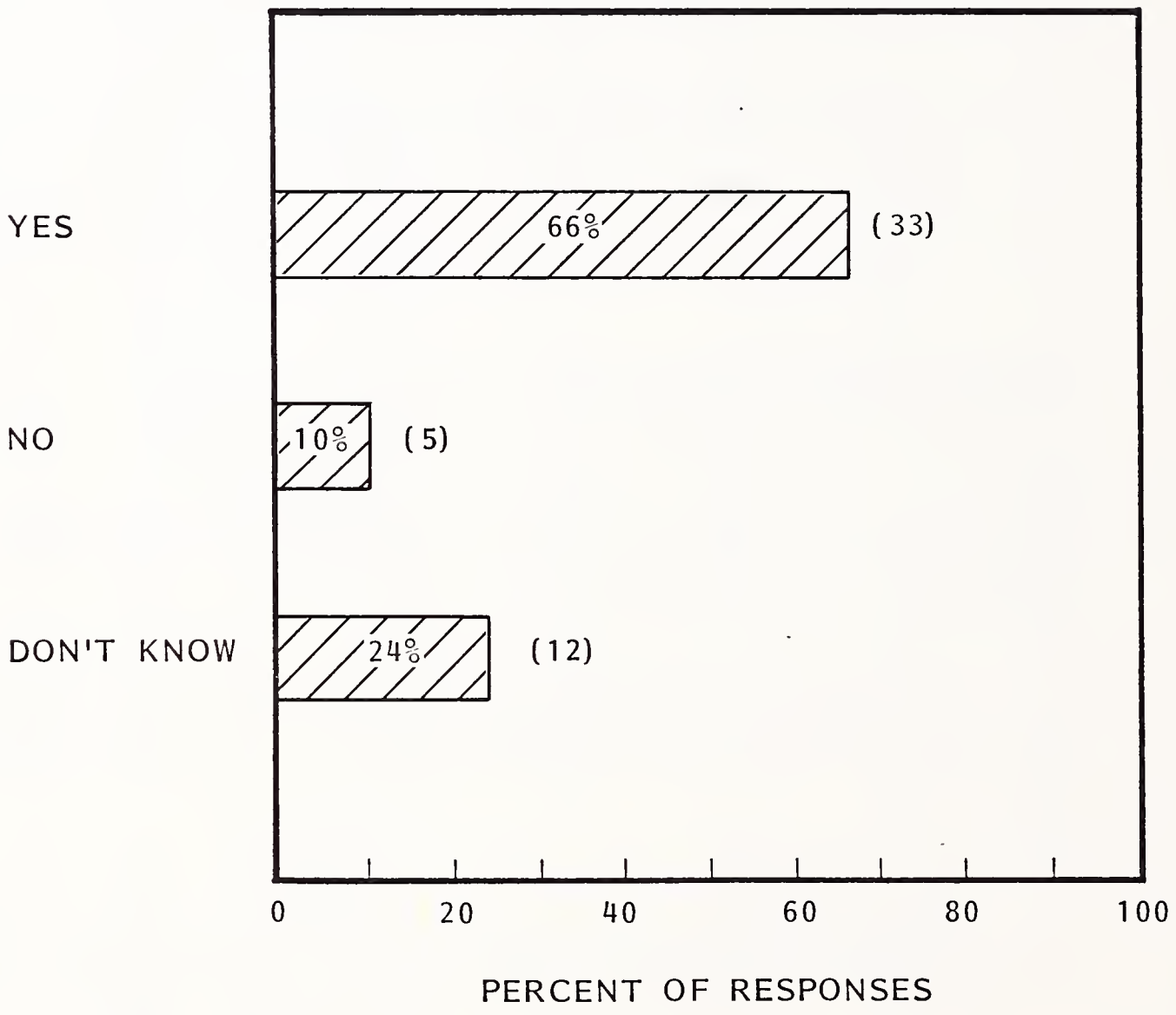
EXHIBIT III-62

SMALL RANGE USERS

RESPONDENT USERS' PERCEPTION OF JAPANESE COMPUTER/ PERIPHERAL INDUSTRY AS A POSSIBLE CONTENDER IN THE U.S. MARKETPLACE



NUMBER OF RESPONSES = 50

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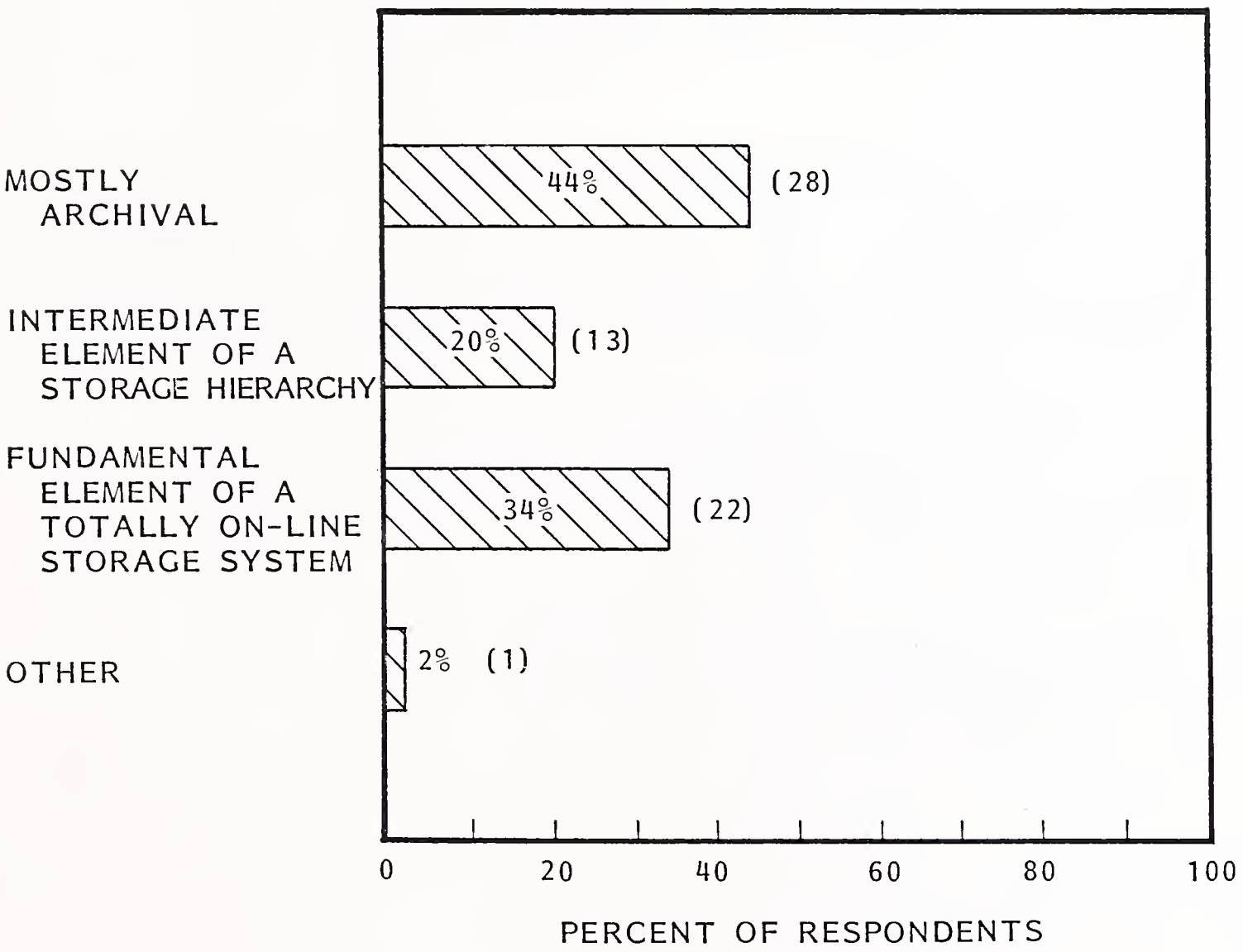
EXHIBIT III-63

SMALL RANGE USERS
RESPONDENT USERS' CONCEPT OF THE MASS STORAGE UTILITY IN THE USER'S OPERATION



NUMBER OF RESPONSES = 64

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EXHIBIT III-64

SMALL RANGE USERS
ANALYSIS OF RESPONDENT USERS'
TAPE LIBRARIES

MAGNETIC TAPE STORAGE	HIGH	LOW	AVERAGE	TOTAL NUMBER OF RESPONSES
TOTAL TAPE REELS IN LIBRARY	2,000	-	165	48
TAPE REELS FOR STORAGE	800	-	181	23
PERCENTAGE OF TAPE REELS UTILIZED FOR DATA	100%	5%	48%	20

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- In addition to those data processing centers which showed no tapes in the library, eight users had fewer than 40 tapes in the entire library.

- Again tape utilization varied, based upon the operating environment. (There were only 61 tape drives installed for 62 computers.)

- Percentage estimates of tape reel utilization showed a lack of information on the part of the user. Surely, the 100% number is incorrect and the 5% figure shows comprehension of - "What ever the percentage is, it's too low."

- At the present time, small range users estimate that their storage is split between 25% tape and 75% disk, and this ratio will not change for 1984, as shown in Exhibit III-65.

  - This inertia is attributed to the installation of fixed disks which require non-tape installation to acquire tape as backup instead of using disk packs.

  - The users appear to have confused audit trail tapes, working storage, and data backup, as each relates to the amount of storage that will be on tape as opposed to disk.

- Exhibits III-66 outlines the effective utilization of disk file space for the small range user. Like the utilization of tape reels, it is probably an optimistic 70%, yet it fits well with the 71% estimated by the medium range and the 69% estimated by the large scale users.

- The users perceive disk files increasing 83% in 1980 above their present installed base, and by 446% for 1984 over 1980, shown in Exhibit III-67.

  - Thirty-seven percent of the respondents attributed this increase to new applications, including converting/consolidating present batch mode to on-line.

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EXHIBIT III-65

SMALL RANGE USERS
ESTIMATE OF RELATIONSHIP OF DISK AND TAPE AS
A PERCENTAGE OF TOTAL STORAGE FOR 1980 AND 1984

STORAGE MEDIUM	1980 TOTAL STORAGE				1984 TOTAL STORAGE			
	HIGH (%)	LOW (%)	AVER-AGE (%)	TOTAL NUMBER OF RE-SPONSES	HIGH (%)	LOW (%)	AVER-AGE (%)	TOTAL NUMBER OF RE-SPONSES
TAPE STORAGE	99%	-	24%	50	99%	-	25%	50
DISK STORAGE	100%	1%	76	50	100	1%	75	50

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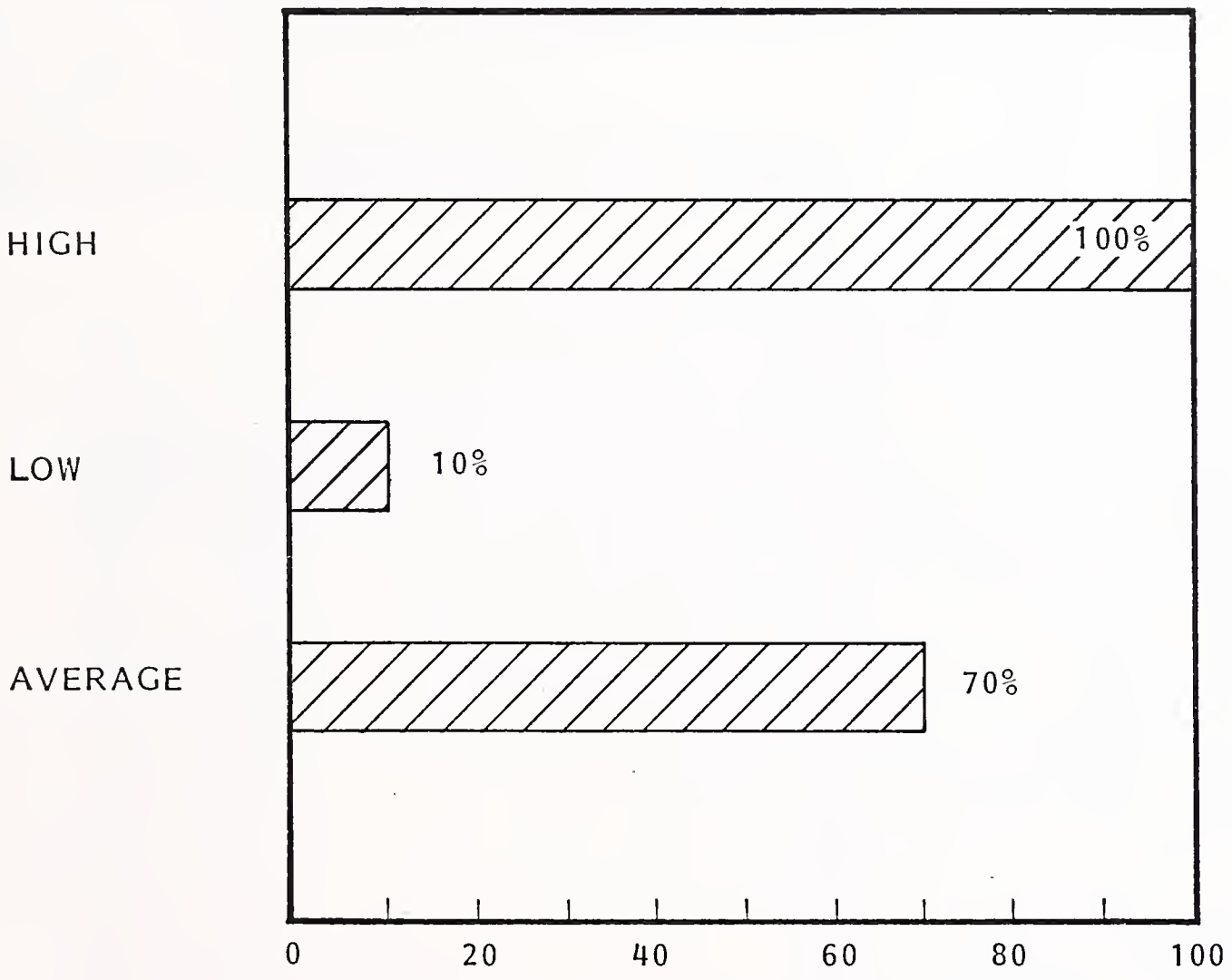
EXHIBIT III-66

SMALL RANGE USERS

ESTIMATE OF ACTUAL DISK

SPACE AVAILABLE THAT IS UTILIZED FOR

DATA STORAGE



NUMBER OF RESPONSES = 48

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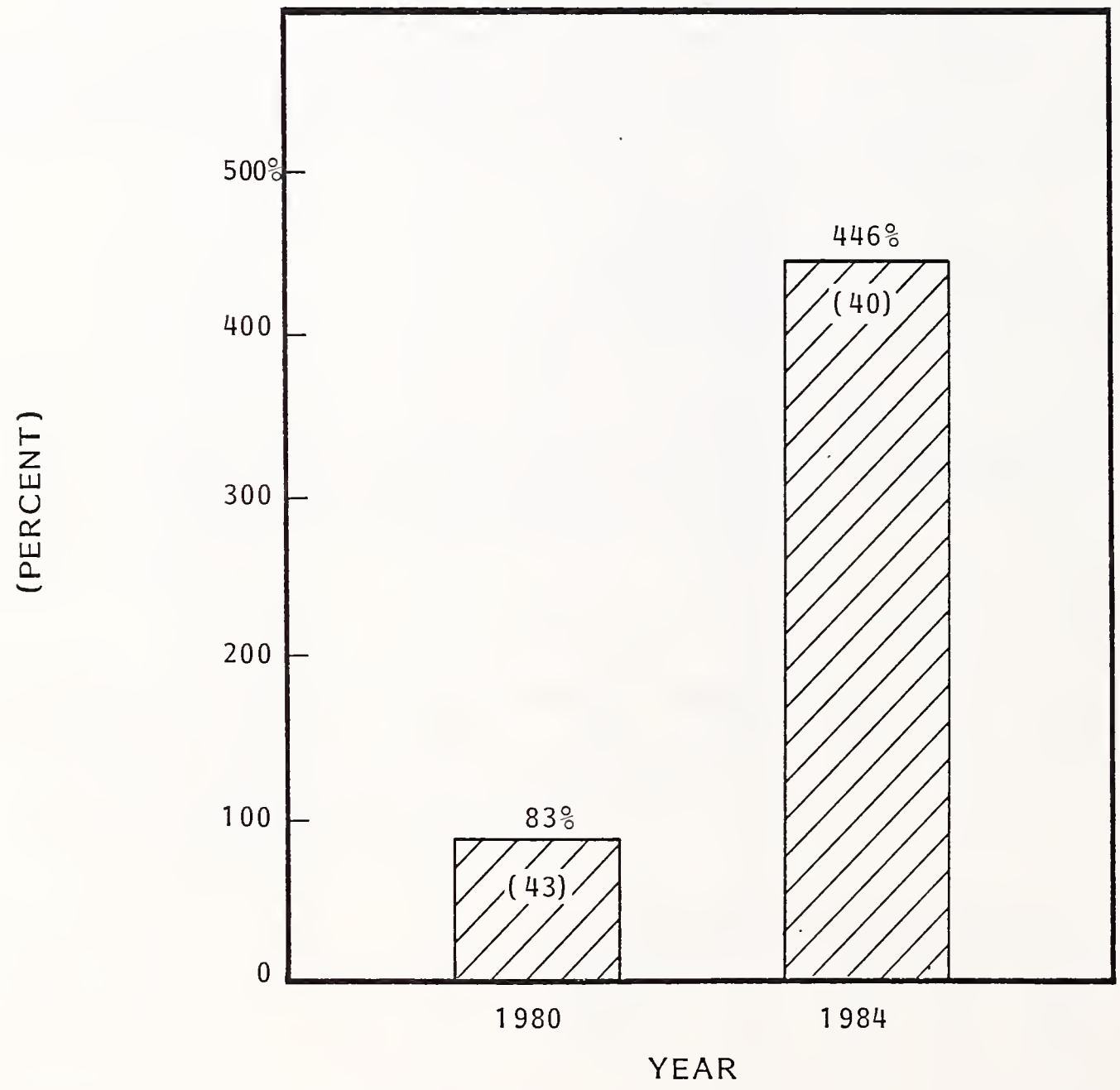
EXHIBIT III-67

SMALL RANGE USERS
PROJECTED AVERAGE INCREASE OF ON-LINE
STORAGE FOR YEAR END 1980 AND 1984



( ) = NUMBER OF RESPONDENTS

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- Fifty-five percent stated it would be a normal growth. Only 7% attributed it to timesharing.

- This growth also tends to verify the user's confusion related to the ratio between tape and disk utilization as a storage medium and their unchanged relationship for the 1980-1984 timeframe.

- Efforts were made to determine what action the user was taking relative to increasing or decreasing "data sets." Users tend to think of these as "files" and had a difficult time defining the terminology, although it was rephrased as files.

  - It is most likely that little is being done to reduce "data sets" since very little effort is being expended or tools made available to determine file utilization. It can be speculated that once a file is added it remains intact or grows regardless of access activity. This could also help to explain the 70% effective utilization the users estimated for their files. "Effective" was the operative word in the survey and without software tools it is a difficult item to pin down.

- Over 80% of the users have a backup recovery system for their on-line storage, as reported in Exhibit III-68; 73% have used it and 94% found it satisfactory.

  - Only two users responded that it was unsatisfactory and one has modified it, but it is unproven since the change.

6. NEW TECHNOLOGY AND STANDARDS

- The small respondent users, when asked about software/firmware tools they would like to see developed, either answered "I don't know" or "I assume they will be available for our new system."

  - As a group they were non-responsive on this issue.

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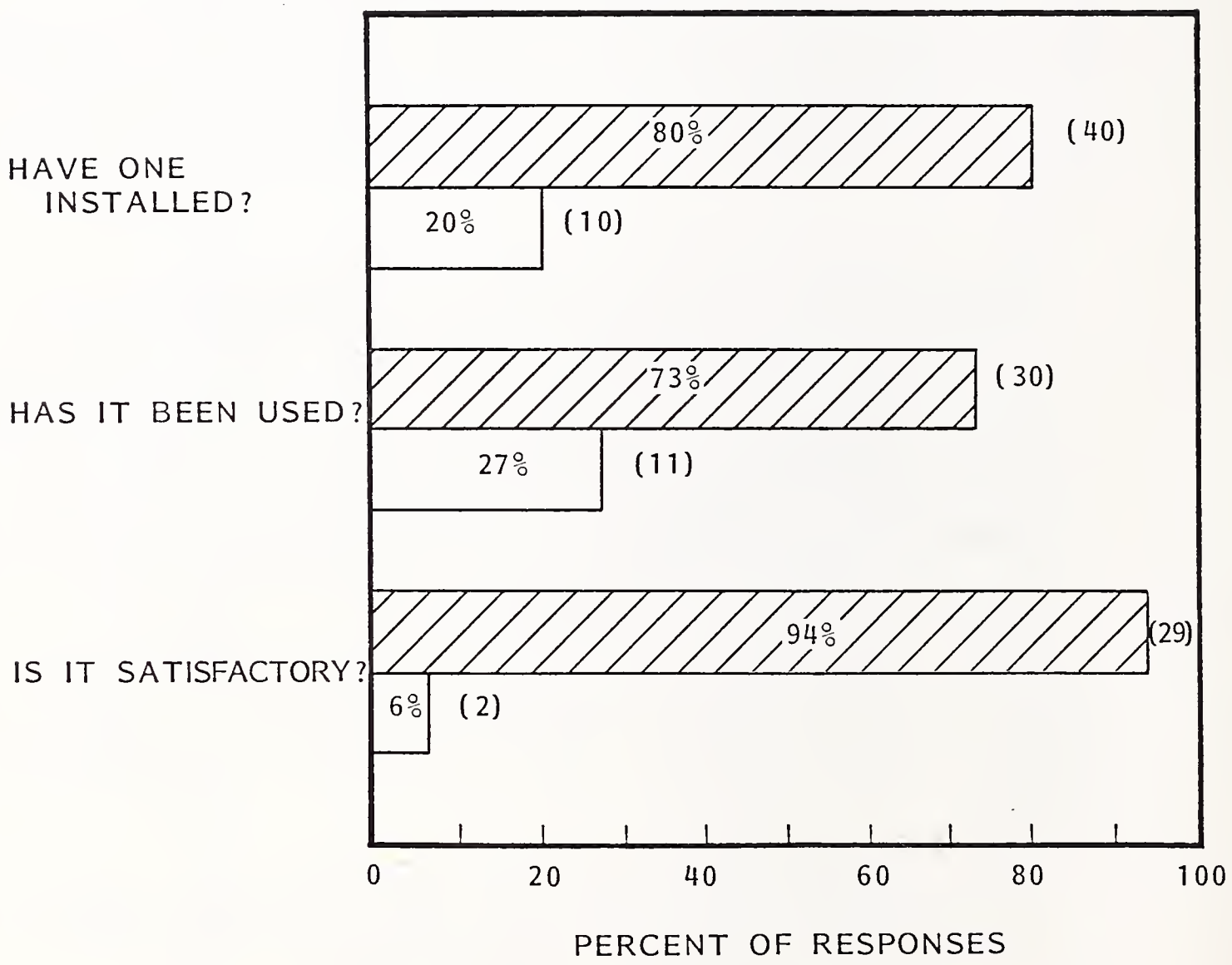
EXHIBIT III-68

SMALL RANGE USERS
STATUS OF BACKUP RECOVERY SYSTEM FOR
ON-LINE STORAGE



( ) = NUMBER OF RESPONSES

YES

NO

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- Seventy-six percent expected the hardware mainframe vendors to supply these tools and 100% expected IBM to supply what they needed in this area.

- The users were also queried about IBM's new technology announcements in the 1980-1981 timeframe. As outlined in Exhibit III-69, the responses suggest:

  - Of the combined "yes" and "no" answers, 74% expected bubble memories and 50% expected hardware DBMS to be available from IBM in some timeframe.

  - The small users, due to the press of running a DP shop with a slim staff, do not have the time to keep current with technology. The "don't know" responses concerning availability of CCDs, flat plane gas discharge CRTs and thin film heads drew a responding 85% to 92%.

  - Bubble memories have been heavily advertised/publicized (i.e., TI terminals) and is a more familiar term. The response to hardware DBMS, no doubt, came from their desire for a useable system and is related to their exposure to the System/38. (Although it is not known exactly how DBMS will be implemented on that system, it can be assumed that it is some combination of hardware/software/firmware.)

- Considering the lack of general future technologies, a startling 71% of the users responded "yes" when asked if the industry would benefit from the concept of architectural standardization, and 63% responded in the affirmative when asked if the user would benefit, as noted in Exhibit III-70.

  - Those who answered "yes" commented:

    . "Helps the user transfer programs without programming."

    . "Would aid geographic users in finding suitable backup facilities."

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EXHIBIT III-69

SMALL RANGE USERS
PROJECTIONS OF NEW IBM
TECHNOLOGIES IN THE 1980-1981 TIMEFRAME

TECHNOLOGY ADVANCE	YES		NO		DON'T KNOW		TOTAL NUMBER OF RESPONSES
	NUMBER OF RE-SPONSES	PERCENT	NUMBER OF RE-SPONSES	PERCENT	NUMBER OF RE-SPONSES	PERCENT	
BUBBLE MEMORIES	32	64%	5	10%	13	26%	50
CHARGE COUPLED DEVICES	4	8	3	6	43	86	50
FLAT PLANE GAS DISCHARGE CRTS	4	8	3	6	42	86	49
HARDWARE DBMS	22	44	3	6	25	50	50
THIN FILM HEADS FOR TAPES	1	2	3	6	46	92	50

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EXHIBIT III-70

SMALL RANGE USERS
REACTION TO THE CONCEPT OF INDUSTRY
ARCHITECTURAL STANDARDIZATION

QUESTION	YES		NO		DON'T KNOW		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
WILL THE INDUSTRY BENEFIT?	32	71%	9	20%	4	9%	45
WILL THE USER BENEFIT?	29	63	16	35	1	2	46

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- "Ease the training effort which is very difficult for small users."

- "Would standardize data bases."

- "Make programming more effective."

- Those who answered "no" commented:

  - "Removes competition."

  - "Resultant products, like standard program languages, would be a compromise and not help anyone."

  - "Prices would all be the same."

- The whole area of architectural standardization is a confused and complex issue that makes agreement on ANSI COBOL appear to be "childs play." It certainly isn't clear to anyone (users, vendors, or the federal government) if it's good, bad, or indifferent.

  - It is in the vendors interest to ensure that, as this issue heats up, they clarify their position to users and help them arrive at an intelligent decision.

7. SOFTWARE

- Fifty percent of the small range users plan to change their systems software; 87% plan to take this action within the next two years.

  - This change will be triggered by the receipt of on-order equipment in 84% of the cases.

- Eighty-nine percent of the small range users acquired their present systems software from the mainframe vendor, and only 18% of those changing

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anticipate a shift away from the mainframe vendor as a source for systems software.

- This is a not unexpected posture for the smaller equipment user, due to lack of available alternatives.

- When small range user respondents were asked about the source of their applications programs, the results were not surprising.

  - Mainframe vendor - 17%.

  - Non-mainframe vendor - 5%.

  - Independent contractor - 6%.

  - Internal development - 72%.

  - Software manufacturers' lack of marketing success is keyed to small range users' perception that "they are different" and "packages require too much modification to fit."

  - The relatively minor use of independent contractors, when compared to large scale users, is a surprise. Comments alluded to "we can do it cheaper, better, faster" and, if done in-house, "we can maintain it better."

  - As in the case of system software, some 30% of the users perceive a change in their sources for applications software and believe that more money will be spent with software houses and internal development. While some are seeking specific packages, the majority have no definite plans as to how, or exactly when, the shift in sources will occur; they only know they will be spending more money.

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- Small range users were asked the status of three types of utility software programs in their operations:

  - Data Base Management Systems.

  - Storage Manager Software Packages.

  - Security Packages.

- Only a small number of respondents were utilizing these programs, as shown in Exhibit III-71.

- None of the respondents have a DBMS system installed.

  - Over 50% are looking forward to installing a DBMS upon receipt of their new system. They would prefer to have one installed now, but are not able to expend the time or effort to do so, even if a suitable one were available. They do not have specific plans as to what they will install, but the general reaction is, "Whatever IBM supplies with my new system."

  - Again the users lack definition of what will be provided, but perceive that they can't go wrong installing IBM.

- Only 8% of the users had a storage management system installed.

  - Once again the reaction was "If I need it, IBM will supply it."

- The answer to an installed security package question elicited approximately the same response. Eight percent of the users surveyed had a security package installed.

  - Users, however, did indicate that the reason for the lack of a security package was due to the limited access to the system with a relatively

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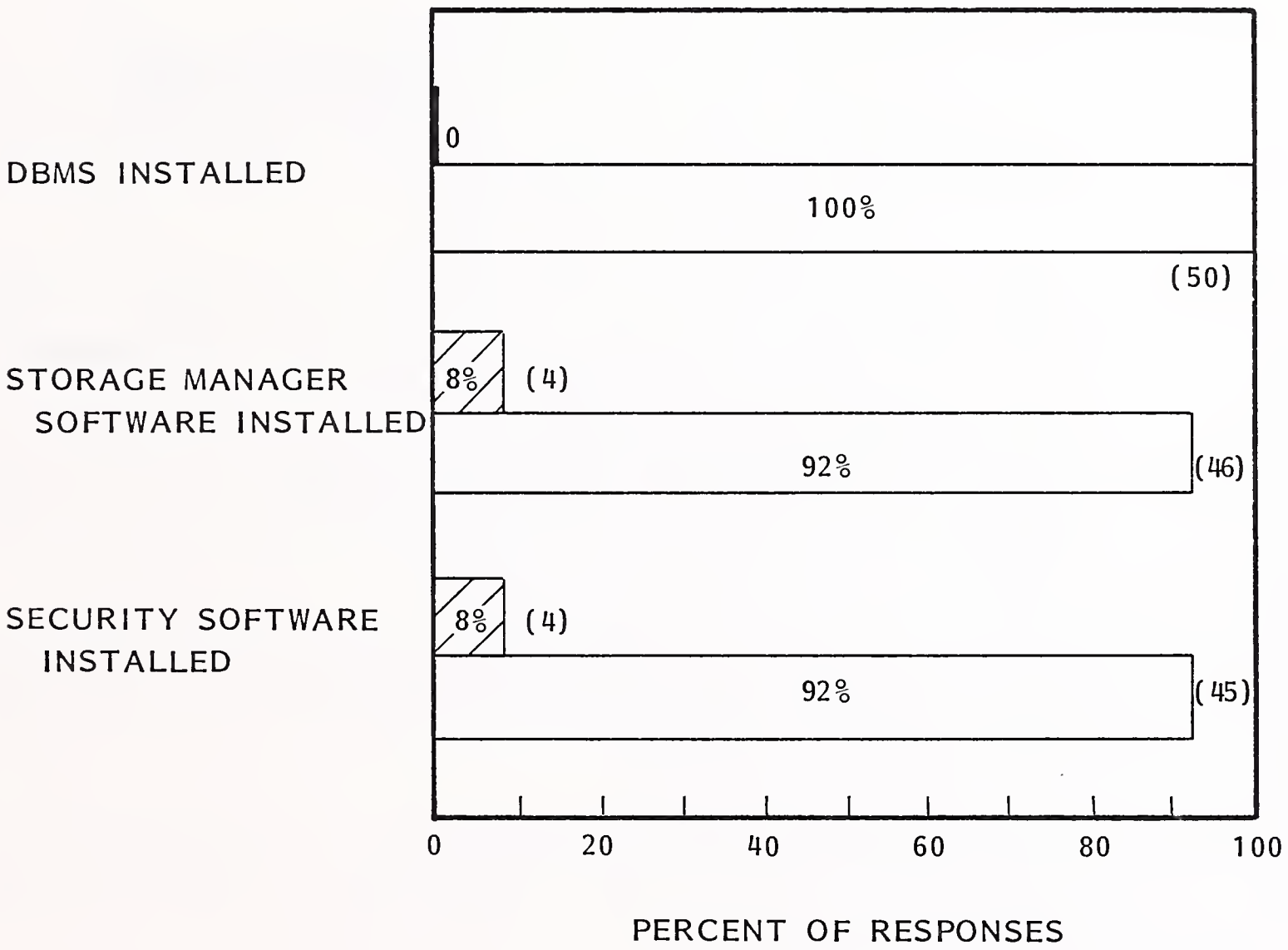
EXHIBIT III-71

SMALL RANGE USERS
STATUS OF UTILIZATION OF UTILITY SOFTWARE PACKAGES



NUMBER OF RESPONDENTS = 50

YES
NO

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small number of terminals. They do anticipate a need for such a system after DBMS is installed, the number of terminals increases, and the transfer of sensitive information is moved from batch to on-line storage.

- Again, the users were asked if they would buy a compatible non-IBM operating system, and an unbelievable 40% responded "affirmative" with 12% as "maybes," as noted in Exhibit III-72.

  - This must reflect the feeling on the part of the users that they have been asking for improved systems software for years and have been delivered "patches."

  - This response also correlates to the overall user's response of 34% stating that PCMs should provide a complete system including software.

  - However, users indicate that just changing system software now would not be worth the effort, as the change will be made on the new on-order system.

- In summary, small users are not pleased with their present software due to the lack of desired features and ease of use and capabilities (which are as much hardware limited as software limited).

  - They are enthusiastic about the new System/38 and other IBM offerings that they perceive as the answer to their problems.

  - IBM has now announced first System/38 shipment will begin June 1980. The small users will be watching and waiting with interest to see:

    . If schedule is kept.

    . The exact nature of the DBMS and its features.

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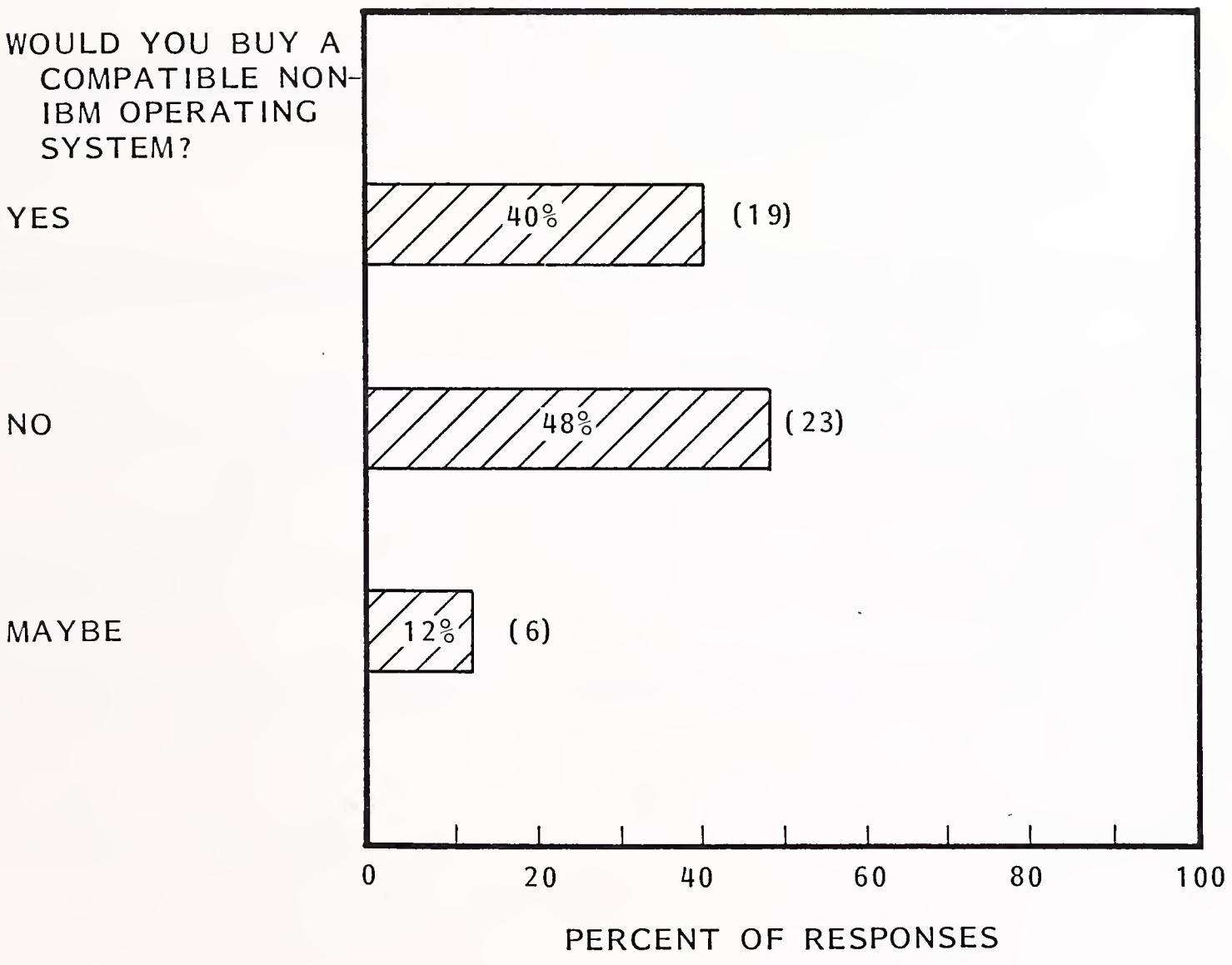
EXHIBIT III-72

SMALL RANGE USERS

ACCEPTANCE OF COMPATIBLE NON-IBM OPERATING SYSTEMS



NUMBER OF RESPONSES = 48

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. The ease of use and performance of the software.

- Any changes in these points from what has been promised could result in considerable re-evaluation of alternatives (if they exist, short of a change to a non-compatible manufacturer).

8. MAINTENANCE

- Sixty-two percent of the small users were aware of the IBM system support centers and, of this number, 38% had experience with these centers, noted in Exhibit III-73.

  - Apparently, the centers are not fully operational for all geographic locations.

- Considering the complete change in the method of user service, the users are pleased with the results - it is a success.

- There are some problems for both the user and IBM. Some comments were:

  - "I believe it takes more time, but I was biased against it to begin with."

  - "They seem to loose calls."

  - "(Our) inability to give the field engineer the right information is a problem."

  - "(I) have to talk to strangers."

  - "Seem to have personnel problems - people out sick or in training."

- Some of the users that had not experienced the system expressed the reasons as:

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EXHIBIT III-73

SMALL RANGE USERS
RESPONDENT USERS' EXPOSURE TO IBM
SYSTEM SUPPORT CENTERS

EXPOSURE	YES		NO		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
KNOWLEDGE OF IBM SYSTEM SUPPORT CENTERS?	31	62%	19	38%	50
EXPERIENCE WITH SYSTEM SUPPORT CENTERS?	12	38	20	62	32

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- "The CE lives five minutes from here and stops every morning on his way to work and stops at night on his way home. We don't place calls."

- "We are in the same building as the center and, if I need help, I walk across the hall and collar the first guy I see."

- Exhibit III-74 indicates that the small range users reaction to contracting all maintenance to a PC/PCM supplier was as expected.

  - While 25% of those that had mixed IBM/PC shops would consider this approach, the sample size of only 12 users is too small to be meaningful.

  - Maintenance costs are of interest to this group of users and will become more of a concern if they decide to purchase their new on-order systems.

- Generally the users were nonplused when asked about remote diagnostics.

  - Most expressed that they didn't know or didn't care and, as long as the equipment got fixed faster, it was OK.

  - Those that had expressed their inadequacies in explaining the specific problem to the support center concluded that this would solve, or aid in solving, that problem and were enthusiastic.

- Responses to the question as to the level the user would participate in maintenance tasks, as depicted in Exhibit III-75, were: willing to run diagnostics or replace boards, but were not willing to pick up from, and deliver to, a central repair site. They were also adament about not doing component level repair.

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EXHIBIT III-74

SMALL RANGE USERS
ATTITUDES TOWARD
SOURCE OF MAINTENANCE

SOURCE OF MAINTENANCE	YES		NO		MAYBE		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
MIXED IBM AND PC OPERATING TODAY	12	25%	37	75%	-	-	49
CONSIDER CONTRACTING ALL MAINTENANCE TO PC SUPPLIER	3	25	8	67	1	8	12
CONSIDER CONTRACTING TO PC SUPPLIER IF IBM A SUBCONTRACTOR	2	26	6	9	4	14	12

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EXHIBIT III-75

SMALL RANGE USERS

WILLINGNESS TO PARTICIPATE
IN MAINTENANCE TASKS

WOULD USER BE WILLING TO:	DO IT YOURSELF?		COOPERATE WITH VENDOR		NOT AT ALL		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
RUN DIAGNOSTICS?	26	53%	9	18%	14	29%	49
REPLACE BOARDS?	21	43	7	14	21	43	49
DELIVER/PICK UP TO CENTRAL REPAIR DEPOT?	10	20	4	8	35	72	49
COMPONENT LEVEL REPAIR?	5	10	8	16	36	74	49

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9. SUMMARY OF SMALL RANGE SYSTEMS USERS

- A case can be made that, as far as PC/PCM vendors (other than terminals) are concerned, the small range systems user is a non-issue.

  - The market exists and is buying complete systems (i.e., DEC, Data General, etc.).

  - The market is not buying PC/PCMs, except for terminals.

  - The users are not interested in mixed vendor shops.

  - The users are not familiar with PC/PCM offerings or advantages.

  - Very little marketing effort (and perhaps rightly so) has been devoted to the small range CPU user.

  - Due to lack of staff, the typical user spends very little time in evaluating equipment and tends to stick with IBM.

  - Very few plug compatible devices are offered in the way of alternatives for this user class, except those with IBM/System 360.

  - Maintenance service is perceived by this group as the largest stumbling block to non-IBM devices. Their fear of receiving even poorer service from a smaller company may not be unfounded.

  - The high end of the small range CPU user market, as defined in this survey, has the potential to move into 43XX, and indeed 18 units are on order for this group. One user is moving from a System/360 Model 40 to a System/360 Model 65. One user commented "GSD and DPD are fighting over me and I love it." Yet, in spite of the system sizes, they are not considering PC/PCMs as alternatives.

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D. OVERVIEW OF THE TOTAL USER RESPONSES

1. PURPOSE

- The purpose of this section is to cover those items on a total response basis where the responses from small, medium, and large range CPU users do not correlate.

- The exhibits for the total responses not used in this section are given in Appendix A.

2. CURRENT INSTALLED AND ON ORDER POSITION

- Exhibit A-1 (see Appendix A, Exhibit A-1: CPUs Installed Or On Order By Respondents) presents a clear picture of the impact of recent IBM announcements, and rumors of announcements, on the survey sample.

  - One of the criteria for selection of users to be surveyed was the size of the installed IBM mainframe. Since the study pertained to user's perception of PC/PCMs, it was a logical key to the sample technique. Therefore, it is not surprising that the users' installed base is predominantly IBM.

  - However, the lack of PCM activity in the users' on-order position is significant.

  - Assuming the survey sample is valid (and there is no reason to believe otherwise) it confirms the market impact of the IBM announcements.

  - On the other hand, the lack of on-order PCMs should not be overemphasized.

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. There seems to be a lack of firm plans relative to acceptance and installation of these devices and the manner in which they are to be used.

. Due to elongated delivery times, the user may run out of processing power prior to delivery of the new system and will require "temporary, pending arrival" equipment.

. As an example, we have already witnessed a change in status in the System/38. It went from scheduled delivery dates to non-scheduled and, now, back to first customer shipment scheduled for June 1980. It is not known, at this date, what the total program slippage will be and its impact on those users who have firm plans and require the increased computing power to continue to function.

. There may be a considerable difference between the announced price/performance and that achieved when hardware and software are installed and running at the customer location. Theoretical and actual price/performance, on a case by case basis, is similiar to EPA gas mileage estimates (perhaps they should carry a similar disclaimer).

- The disk drive picture is not clear. (See Appendix A, Exhibit A-2: Disk Drives Installed Or On Order By Respondents.)

  - The 24% installed base penetration by PCs could be considered to be encouraging and does indeed exceed the generally accepted 20% considered by many as the level of the PC disk file market.

- The on-order position for disk drives is where the situation becomes cloudy. There are only 256 drives on order versus 2,042 drives installed.

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- This reflects an on-order position far below users' projected growth (86%) in utilization of disks for the end of 1980.

  . This tends to confirm the earlier situation relative to CPUs on order and the feeling that the users' plans for these units were not firmed up.

  . In responding to the survey, users may have assumed the entire 43XX system was included when they covered their on-order status and may have disks on order that were not mentioned as a separate item.

  . Of the 256 drives on order, only 16% (41 units) represent plug compatible drives. Most likely, these units are meant to connect to installed, rather than on-order, systems.

- The tape drive market (see Appendix A, Exhibit A-3: Tape Drives Installed Or On Order By Respondents) closely parallels that of disk drives.

  - Of the 958 units installed, 31% (296 units) are plug compatible devices. None of the 34 on-order units are from PC vendors.

  - While the market growth for tape drives is projected to be far lower than that of disk drives, it is certainly growing faster than the 3.5% reflected in these numbers. Hence, one must conclude that the same reasons for lack of disks on order can also be applied to tapes.

- IBM has 239 printers installed and PCs have 34 (12%). (See Appendix A, Exhibit A-4: Equipment Installed Or On Order By Respondents).

  - No PC printers were reported on order by the respondent users.

- The terminal situation presents a different picture as it relates to the IBM and PC/PCM installation ratio for other devices (see Appendix A, Exhibit A-5).

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- The survey showed a total of 14,308 terminals installed of which 2,397, or 17%, were supplied by PC vendors.

- Normally the PC/PCM vendors find their most fertile fields in the medium range and large scale CPU user market. However, in the case of terminals, the highest market penetration is with the small range user, at 31%. The medium range user was next, at 21%, and lastly the large scale user, at 16%. The large scale CPU users surveyed represent 87% of the installed terminals versus 2% for the small range user and 11% for medium range users. Therefore, one percentage point in sales to the large is worth far more than the small in terms of units.

- As far as on-order terminals are concerned, the PC vendors achieved a 26% market penetration.

- The net result of the on-order position does not paint a very bright picture for the PC/PCMs in any of the major groups.

  - With the exception of terminals, the reported on-order position for PC/PCM vendors is either zero or close to it.

  - The PCs may have some opportunities in this area when the question of attachability to the newer IBM mainframes is clarified. One can conclude, due to the small quantities ordered, that customers have not firmed up their plans or systems configurations.

  - Even if one deduces that the users perceive that PC/PCMs have short delivery schedules and, hence, show very little backlog, it is difficult to explain the poor results portrayed by this survey relative to the on-order position.

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3. PURCHASE VERSUS LEASE

- Historically, 70 (47%) of the respondent users purchased all or most of their computer system, as shown in Exhibit III-76.

  - In view of the rapidity of recent announcements by IBM and counter announcements by PC/PCM vendors, 27 (39%) of the 70 respondents have indicated they will switch to leasing their equipment, which is pointed out in Exhibit III-77.

  - If this percentage change holds true for the entire market, it tends to verify the much publicized projected impact on vendors' revenues. It also adds credence to IBM's recent bond issue, because of its tremendous impact on cash flow.

  - Users tend to believe:

    . There will be further price/performance changes coming (and no doubt they are right).

    . The elongated delivery schedules, plus the required pay out time, make front end purchase commitments too risky.

    . The new price/performance curves will impact the used computer market (once volume shipments commence) and hence upgrade possibilities will exist at better than "state of the art" prices.

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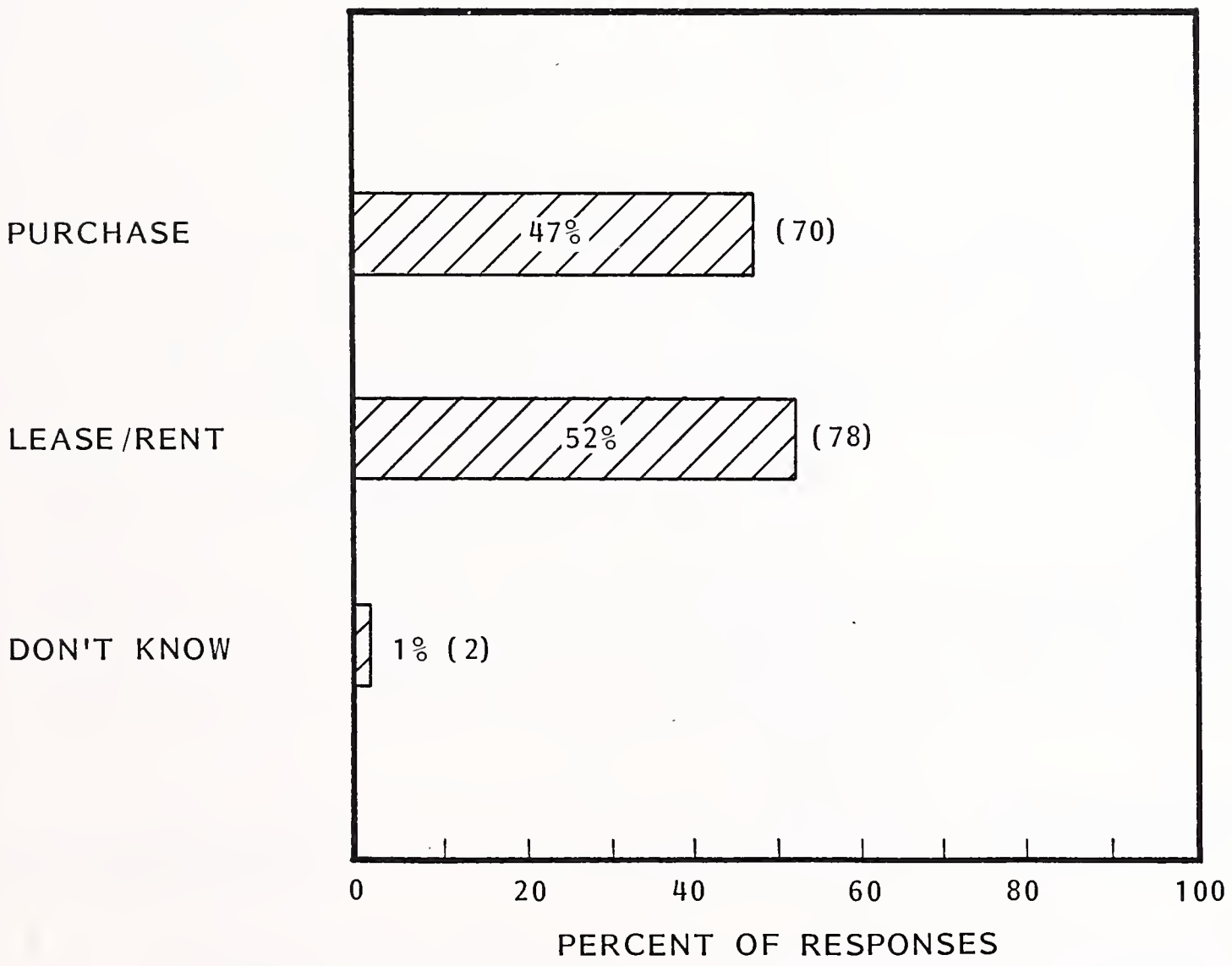
EXHIBIT III-76

RESPONDENT USERS
PRESENT METHOD
OF EQUIPMENT ACQUISITION



NUMBER OF RESPONSES = 150

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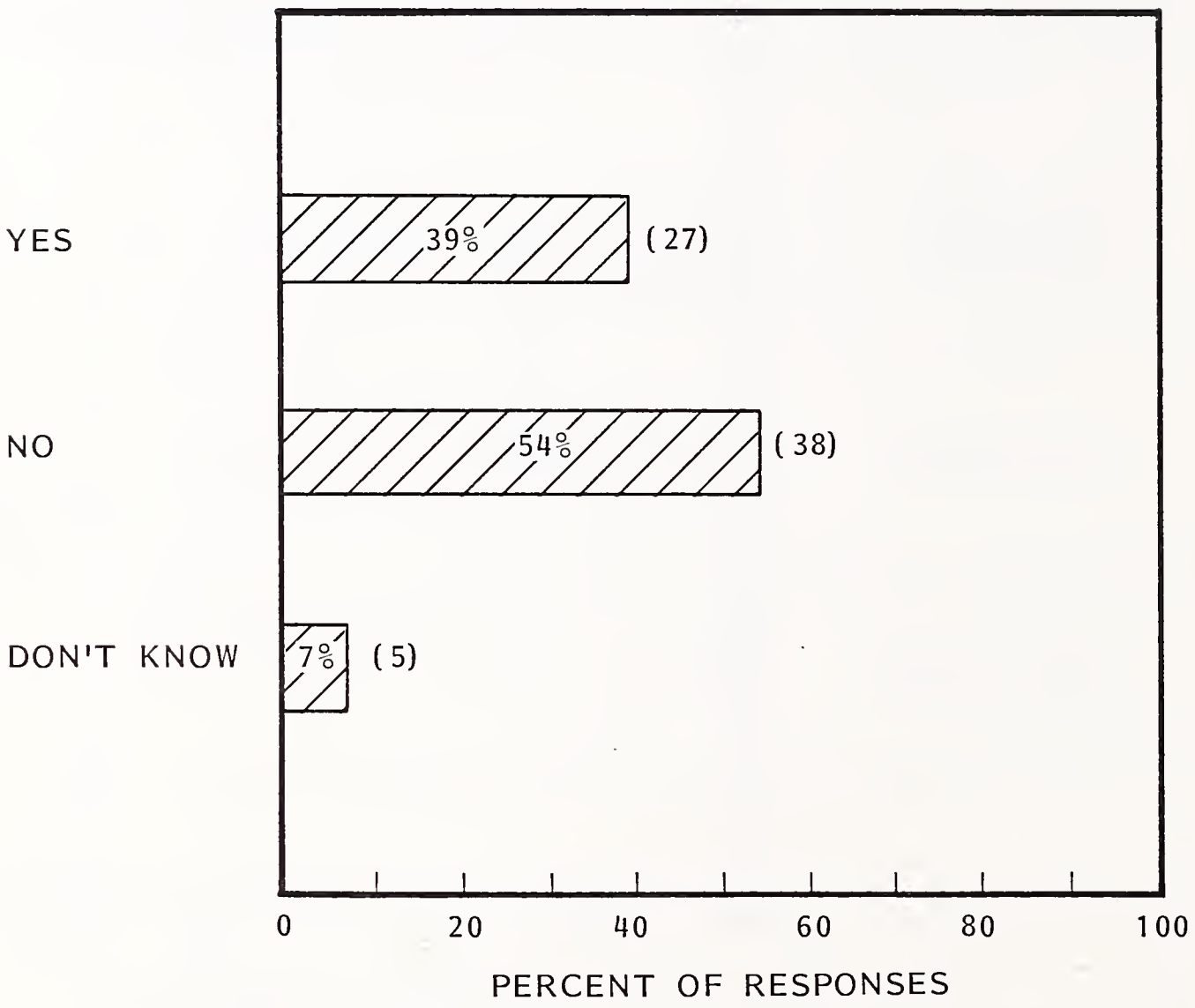
EXHIBIT III-77

RESPONDENT USERS
PERCEIVED CHANGE OF PURCHASE TO LEASE AS A METHOD OF EQUIPMENT ACQUISITION



NUMBER OF RESPONSES = 70

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- Many of the users who professed to have changed their buying habits, seem to be marking time. If the market has settled by the time they must confirm their delivery schedule, or after installation, they will (most likely) revert to purchase. However, dependence upon this switch occurring becomes a risk for the vendors and one they prefer not to take. They must assume the user will not purchase and seek capital funding.

- Exhibit III-78 lists those devices that users normally purchase and will now lease.

  - It is interesting to note that 35% of the predicted change from purchase to lease affects the CPU. Hence, the users perceive the price/performance impact will be greater on CPUs, and that peripheral devices will tend to hold their price and/or have a longer useful life.

4. STORAGE REQUIREMENTS

- One of the more interesting findings in this survey has been the grasp of the concept of "mass storage utility" by the majority of the users, regardless of their CPU size classification, as illustrated in Exhibit III-79.

  - The concept of on-line storage has been effectively sold throughout the industry.

  - As a group, respondent users showed a shift of 10% (as shown in Exhibit III-80) in the utilization of disk drives as opposed to tape drives for a data storage medium for the period 1980 to 1984.

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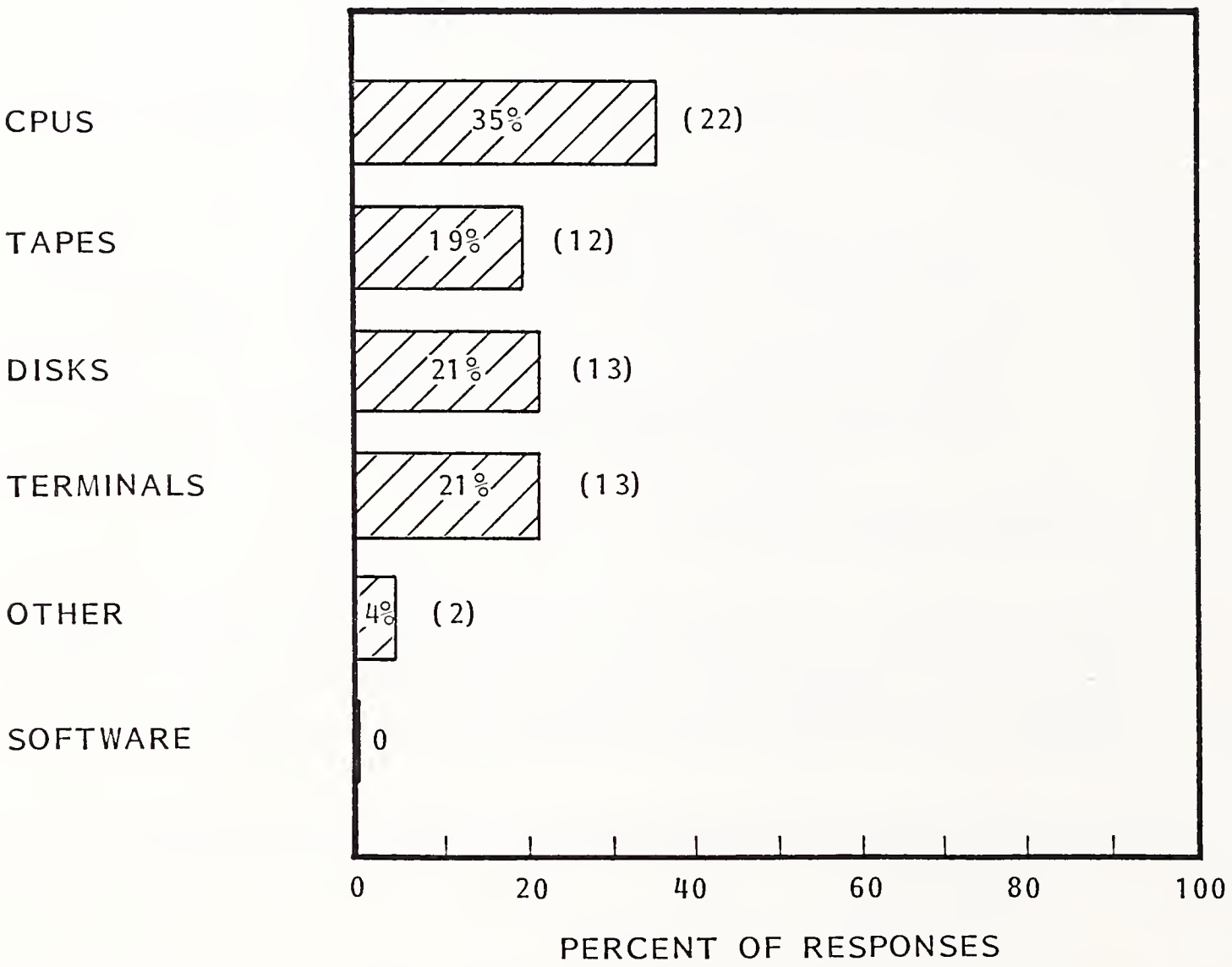
EXHIBIT III-78

RESPONDENT USERS
TYPES OF EQUIPMENT AFFECTED IN CHANGE
FROM PURCHASE TO LEASE



NUMBER OF RESPONSES = 62

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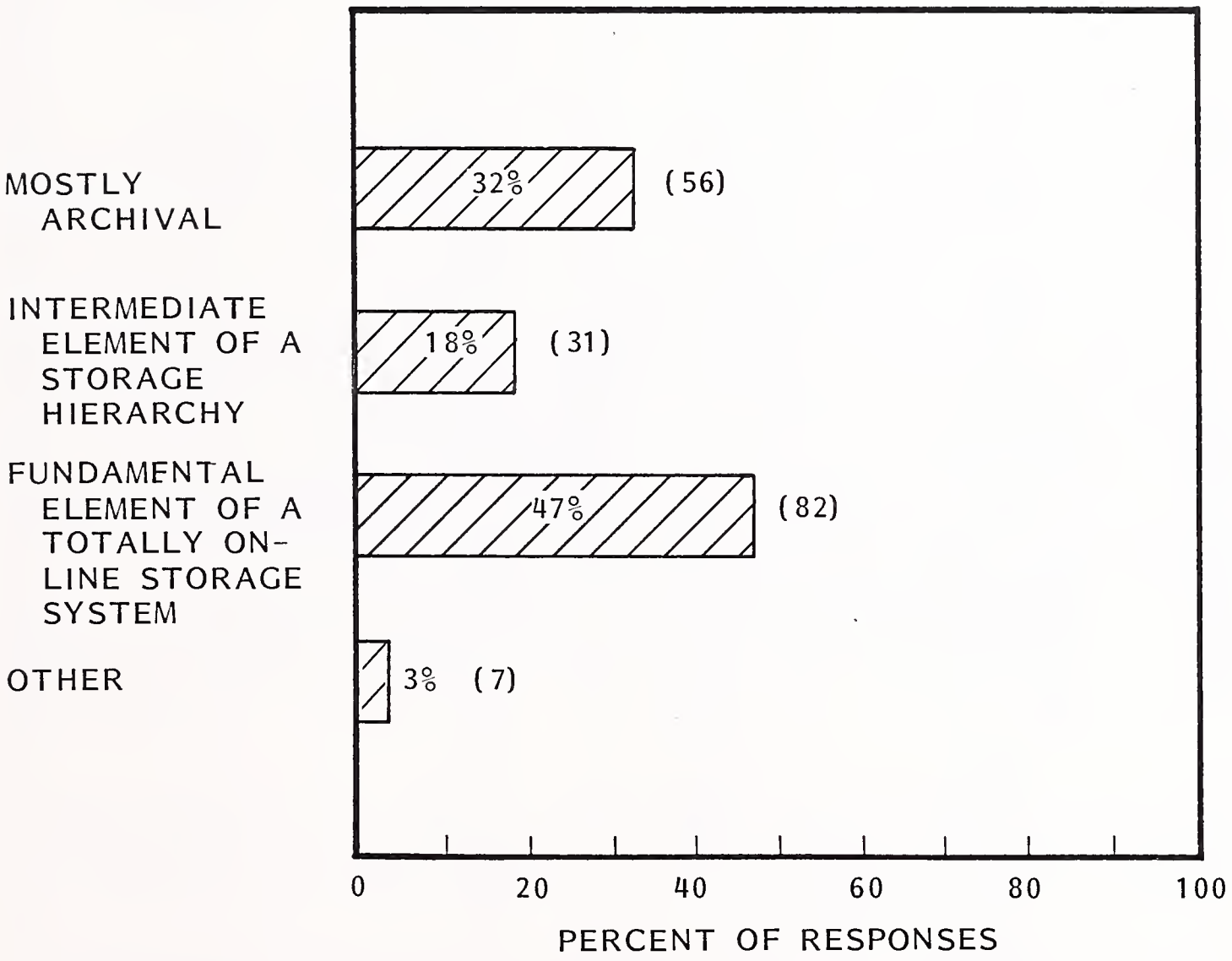
EXHIBIT III-79

RESPONDENT USERS
CONCEPT OF THE MASS STORAGE
UTILITY IN THE USERS' OPERATION



NUMBER OF RESPONSES = 176

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EXHIBIT III-80

RESPONDENT USERS
ESTIMATE OF RELATIONSHIP OF DISK AND TAPE AS
A PERCENTAGE OF TOTAL STORAGE FOR 1980 AND 1984

STORAGE MEDIUM	1980 TOTAL STORAGE				1984 TOTAL STORAGE			
	HIGH	LOW	AVERAGE	TOTAL NUMBER OF RESPONSES	HIGH	LOW	AVERAGE	TOTAL NUMBER OF RESPONSES
TAPE STORAGE	100%	–	43%	133	100%	–	33%	127
DISK STORAGE	100%	–	57	133	100	–	67	127

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- This shift of only 10% is somewhat misleading. The respondents also gave equal weight to tape as a storage medium when it was used for backup to fixed disks.

- The confusion can be seen in Exhibit III-81 which addresses the growth for all users in on-line storage for 1980 (86%) and 1984 (over 1980) of 335%.

- The respondent users reported, as noted in Exhibit III-82, an estimated 70% effective utilization of available disk file space. This percentage appeared to be high, so a special correlative analysis was made of those users who had storage manager software installed to determine their percentage utilization of available disk file space. A total of 21 users reported having storage managers installed. Fourteen of these users (67%) had estimated their utilization at between 70-81%. While this number supports the average number of 70% for all respondents, the word "effective" may have been lost in the answer. However, as long as the users preceive such a high level of utilization they will continue to acquire additional capacity - which is good for the vendors.

5. SOFTWARE

- The respondent users showed a knowledge of the inadequacies of their presently installed system software.

  - Of 146 respondent users, 99 (68%) plan to add or change their present system software.

  - Eighty-nine percent of those changing, plan to make the change in the next two years.

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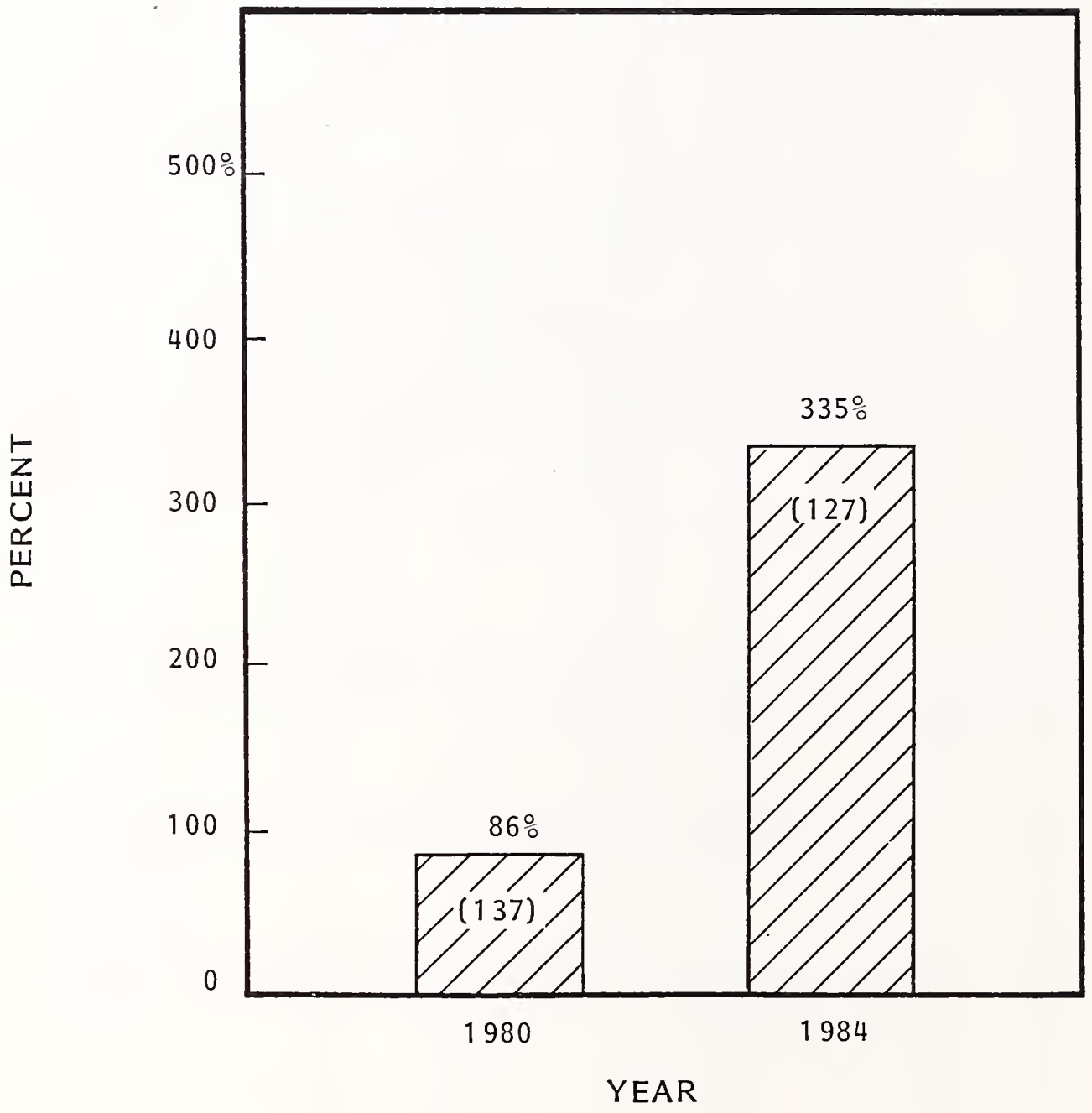
EXHIBIT III-81

RESPONDENT USERS
PROJECTED AVERAGE INCREASE OF
ON-LINE STORAGE FOR YEAR END
1980 AND 1984



( ) = NUMBER OF RESPONSES

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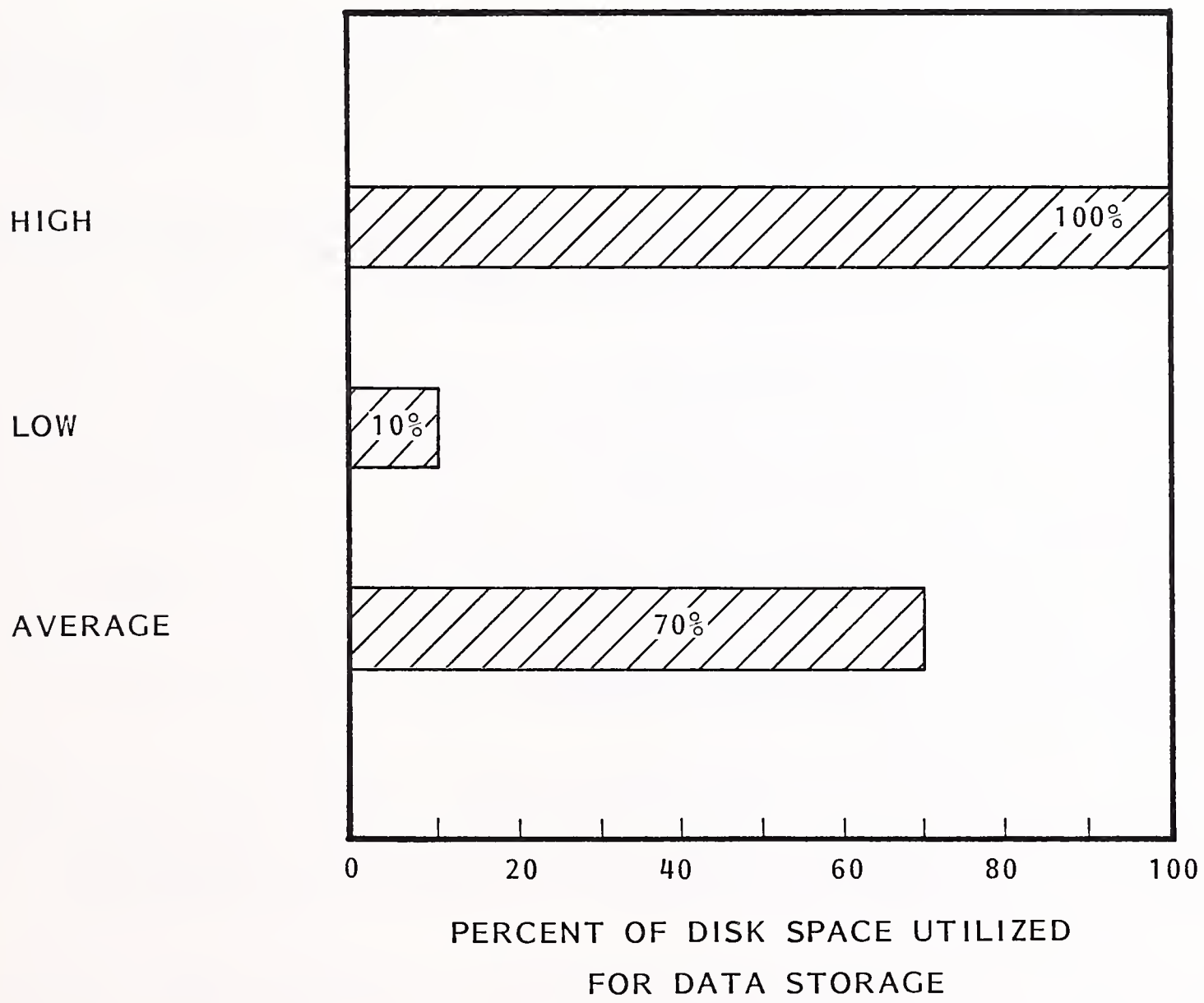
EXHIBIT III-82

RESPONDENT USERS

ESTIMATE OF ACTUAL DISK SPACE
AVAILABLE THAT IS UTILIZED FOR DATA STORAGE



NUMBER OF RESPONSES = 139

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- Thirty-seven percent are changing the system software on their presently installed equipment. This number alone portrays a high percentage of dissatisfaction with the performance of the present system software.

- It is not surprising that 70% of the respondents acquired their system software from the mainframe vendor.

  - Only 31 (22%) of the 144 users were planning to change their source of system software.

- When asked about their source for applications software, 139 (57%) responded that these packages were developed internally.

  - The other sources were:

    . Mainframe vendor 29 (12%)

    . Non-mainframe vendor 45 (18%)

    . Independent contractor 31 (13%)

  - One of the more interesting numbers related to the use of independent contractors by large scale users. Of the 102 responses, 23 used independent contractors as a source for applications software.

    . Either these contractors are concentrating their sales effort on the large scale user; or the large scale user, because of staff size, can effectively retain and manage external resources more readily than medium or small range users.

  - Only 38 (26%) of the total respondent users anticipated a change in the source for their applications software.

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- Exhibit III-83 addresses the utilization of three types of utility software packages by user respondents.

  - Data Base Management Systems.

  - Storage Manager Software Packages.

  - Security Packages.

- Fifty out of 148 users (34%) had a data base management system installed.

  - Fully half of the 98 respondents answering negatively to this question, planned to install a DBMS within the next two years.

  - These plans are keyed to delivery, by IBM, of a useable DBMS for the System/34, System/38, and 4300 series.

    . If the new DBMS is as difficult and awkward as IMS then the users' plans will change. However, their desire for on-line systems will be fullfilled even if it means acquiring non-IBM software. The users perceive that on-line systems are the future of DP.

- Only 22 (15%) of the 148 respondent users had a storage manager software package installed.

  - Sixty-four percent (69 responses of a total of 111) expected the mainframe vendor to offer software/firmware to handle the storage manager problem.

  - Eighty-eight percent (70 respondents of a total of 90) anticipated that IBM would supply the required tools for storage management.

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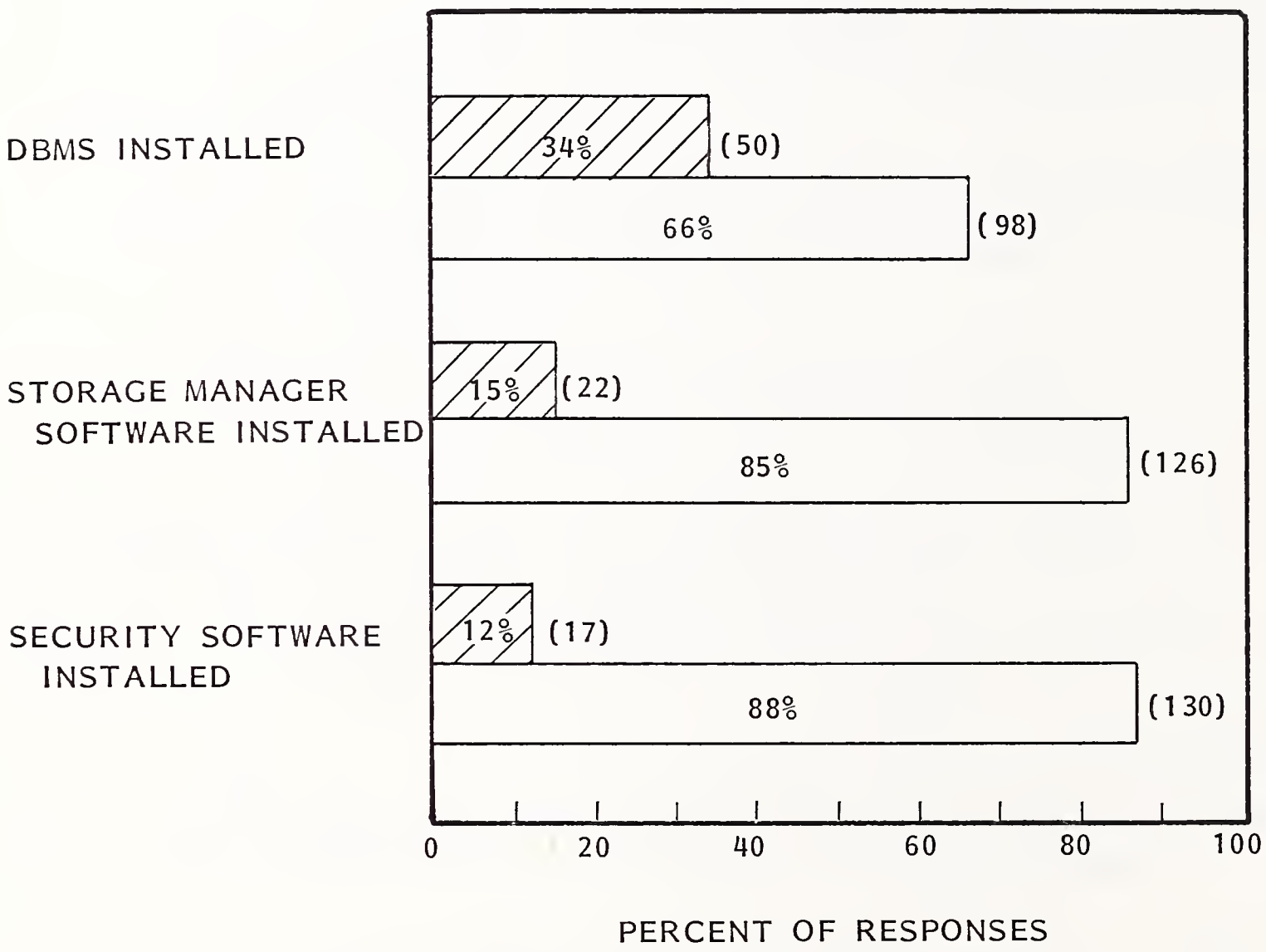
EXHIBIT III-83

RESPONDENT USERS
STATUS OF UTILIZATION OF UTILITY SOFTWARE PACKAGES



NUMBER OF RESPONSES = 148

YES
NO

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- The majority of the users believed that storage management would be an intergral part of any new DBMS.

- In spite of the general press and publicity, only 17 (12%) of the 147 respondent users had a security software package installed.

  - There were several reasons put forward by the users for this limited utilization:

    . If installed with the present software system, it may not be possible to carry it forward to the new system.

    . Available packages are too difficult to install and utilize.

    . Applications that are installed in on-line systems do not contain sensitive information. The programs that do contain proprietary or sensitive information are still being processed in the batch mode and, hence, access is easy to control.

  - The advent of increased utilization of on-line systems have made the users aware of the need for a security package. They are beginning to examine this area, but will not commit until the form, structure, and content of the new IBM DBMS is clarified.

- In spite of the respondent users preference for IBM, Exhibit III-84 shows that 45 (31%) would buy a compatible non-IBM operating system.

  - Ease of use was the overwhelming reason given as an alternative to IBM.

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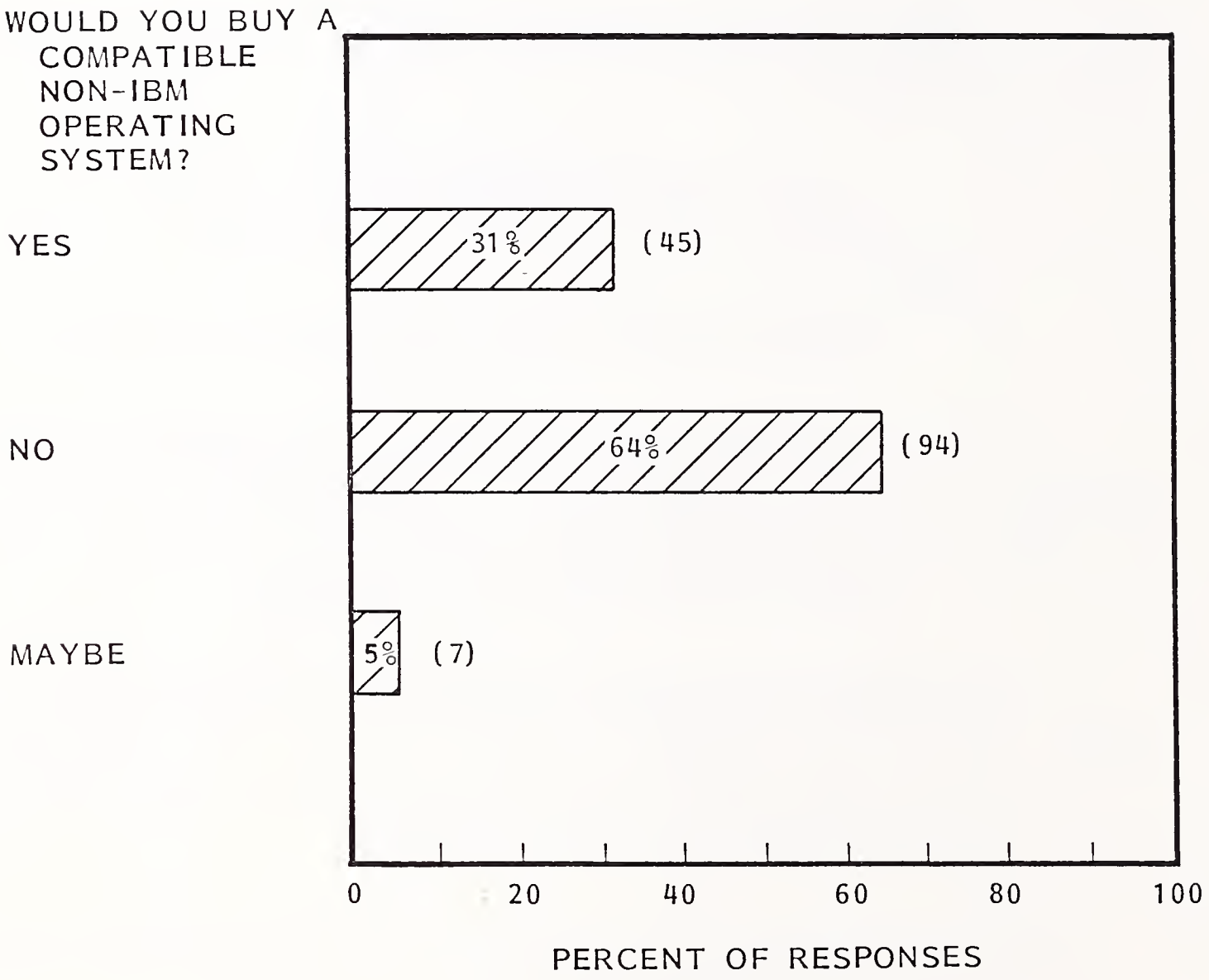
EXHIBIT III-84

RESPONDENT USERS

ACCEPTANCE OF COMPATIBLE NON-IBM

OPERATING SYSTEMS



NUMBER OF RESPONSES = 146

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6. MAINTENANCE

- One of the more interesting findings of the survey (depicted in Exhibit III-85) is the excellent marketing job IBM has accomplished in selling the concept of systems support centers.

  - Eighty-five percent of the respondent users had knowledge of these centers and their purpose.

  - Fifty-one percent of the users had used the system support centers and their reaction was overwhelmingly favorable.

  - Apparently, the only major problem left for IBM to handle is remote diagnostics. Users expressed difficulty in adequately explaining their problem to field engineers over the phone.

7. SUMMARY

- Some of the more interesting results of the survey reflected in the total numbers are:

  - The growth of on-line systems.

  - The need for better DBMS.

  - The users' acceptance of the new IBM products.

  - The extremely low number of PC/PCM devices on order.

  - A growing user concern about the complex human interface of present systems software packages.

  - The need for PC/PCM vendors to offer more than just a price/performance box replacement to attract the users' attention.

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EXHIBIT III-85

RESPONDENT USERS

RESPONDENT USERS' EXPOSURE TO IBM SYSTEM SUPPORT CENTERS

EXPOSURE	YES		NO		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
KNOWLEDGE OF IBM SYSTEM SUPPORT CENTERS?	126	85%	22	15%	148
EXPERIENCE WITH SYSTEM SUPPORT CENTERS?	65	51	63	49	128

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- The position that only one-third of the respondents would be motivated by a 30% or less cost savings to install compatible devices.

- The favorable acceptance of the new IBM systems support centers.

- Users are switching from purchase to lease, as a means of acquiring EDP.

- Elongated IBM deliveries are impacting user planning and also providing short term opportunities for PC/PCM vendors.

- Users are wary of PC/PCM vendors because of the collapse of Itel, which was perceived as a strong financial operation.

- PC/PCM vendors need better sales coverage, and the level of the marketing representatives needs to be upgraded to be able to explain the numerous financial advantages at the vice president level.

- Maintenance is the major reason why respondent users will not buy from PC/PCM vendors.

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IV VENDOR SURVEY ANALYSIS

IV VENDOR SURVEY ANALYSIS

A. INTRODUCTION

- This chapter provides a composite analysis of vendors' attitudes toward and perceptions of the current and future PC/PCM marketplace. Differences in perception among mainframe, peripheral and software vendors, are differentiated in the text.

B. VENDORS' PERCEIVED ADVANTAGES OVER IBM

- Exhibit IV-1 provides a listing of the vendors' perceived advantages over IBM among the companies interviewed.

- PC/PCM vendors have not altered their traditional view that price and delivery are the two major advantages that they offer over IBM.

  - This was particularly true for both the peripheral and mainframe vendors interviewed.

  - Software vendors believed their products were superior to IBM's from the standpoint of ease of use, efficiency, and improved performance.

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EXHIBIT IV-1

VENDORS' PERCEIVED ADVANTAGES OVER IBM
BY COMPANIES INTERVIEWED

VENDOR ADVANTAGES	NUMBER OF MENTIONS
PRICE	9
DELIVERY	6
EASE OF USE	3
RELIABILITY/AVAILABILITY	3
ADDITIONAL FEATURES	3
EFFICIENCY	2
PERFORMANCE	1
SUPPORT	1

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- Hardware vendors feel they are forced to remain in a reactive mode, since they must wait for IBM announcements on both price and delivery schedules before they can initiate any actions.

C. MAJOR COMPETITORS IN PC/PCM MARKETPLACE

- Exhibit IV-2 provides a tabulation of the vendors identified as the major competitors among the companies interviewed.

- In all three product areas, IBM is perceived as the major competitor. Other PCMs are not considered to be significant competitors.

- It appears that the nature of this particular marketplace requires the primary attention to be directed at IBM; there are no other competitors that occupy any position of dominance within the marketplace.

- An area of growing concern to all PC/PCM vendors is the proliferation of used IBM equipment available from used or third party dealers.

  - When IBM begins volume delivery of the 4300 series, it will displace installed 360/370 family equipment which will be put on the used equipment market at lower cost than the 4300 for equivalent price/performance.

  - This used equipment will become an important factor in the small and medium size user market.

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EXHIBIT IV-2

MAJOR COMPETITORS AS SEEN
BY COMPANIES INTERVIEWED

MAINFRAMES		PERIPHERALS		SOFTWARE	
COMPANY	NUMBER OF MENTIONS	COMPANY	NUMBER OF MENTIONS	COMPANY	NUMBER OF MENTIONS
IBM	5	IBM	5	IBM	4
DEC	2	MAGNUSON	2	COMPUTER ASSOC.	1
BASIC/FOUR	1	ITT/ COURIER	3	SOFTWARE A.G.	2
FOUR-PHASE	1	STC	3	ADR	1
HEWLETT-PACKARD	1	RAYTHEON	2	CULLINANE	1
PRIME	1	DATA 100	1	INFOR-MATICS	1
UNIVAC	1	FOUR-PHASE	1		
		MEMOREX	1		
		NORTHERN TELECOM	1		
		SYCOR	1		
		TELEX	1		

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D. VENDORS' RESPONSE TO 4300 ANNOUNCEMENT

- Since the introduction of the 4300 into the markeplace had such a strategic impact on the total PC/PCM market, companies reactions were examined from the standpoint of opportunities created, problem areas, and reactions.

- The information provided by the vendors clearly does not reflect the impact that the 4300 announcement has had on the PC/PCM market. In general all PC/PCMs viewed the 4300 through "rose colored glasses." Typical responses were:

  - "Broadened the market."

  - "Created more prospects."

  - "IBM endorsed DDP as a concept."

  - "Established a new price/performance level which we can match profitably."

- The PC/PCM vendors acknowledged only two major areas of concern:

  - The announcements and rumors delayed purchase decisions.

  - New price/performance ratios created some profit squeeze.

- The only methods adopted to combat the 4300 were:

  - Reducing prices of present products.

  - Announcing new models to compete with known IBM products and those attempting to fill obvious gaps in the IBM product line.

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- One vendor projected the intermediate mainframe market (370/158 or less) as:

  1980 - 14,000 units
  1981 - 16,100 units
  1982 - 19,700 units
  1983 - 24,500 units

  and his companies' market penetration (in spite of the 43XX) growing to 10% by 1983.

- Apparently, the strategy for PCM vendors competing with the 4300 is to:

  - Keep prices around the $250,000 per MIPS (million of instructions per second) level.

  - Vertically integrate, to include marketing, manufacturing, R&D, and software. Companies that depend on a heavy OEM source base will have a difficult time maintaining margins sufficient to stay competitive with IBM.

- Most vendors in this market perceive a need to provide total systems.

E. VENDORS' PERCEPTION OF "H" SERIES

- The rumors relating to an IBM announcement of the "H" Series (a high end replacement for System/168 and 30XX devices) is very much in the minds of most vendors.

  - The new series is stalling end user decision to move.

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- Vendors have very little hard data on what the "H" series will look like. While there are several blanks in the 8100 and 43XX series, at least the price/performance and delivery schedules have been declared.

- Over 50% of all vendors interviewed expect the "H" Series to be announced prior to the end of the second quarter 1980.

- The vendors interviewed also anticipated that the "H" Series would:

  - Be three to four times the price/performance of the 3033.

  - Be announced six months after the price adjustment of the 30XX which occurred in November 1979.

  - Be available in 20 to 128 megabyte main memory.

  - Have a performance in the range of 15 to 17 MIPS.

  - Be air cooled.

  - Have a two level bubble cache memory of 64-128K.

  - Offer a relational data base management system.

- Major concerns, on the part of the vendors, again expressed:

  - New price/performance levels.

  - Delays in user decision making awaiting announcement.

- None of the vendors appeared concerned about:

  - A two-byte wide interface.

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- The possibility of embedded firmware as it relates to systems software.

- The difficulty embodied in attachment of plug compatible devices to either the 4300 or the "H" Series.

F. VENDORS' PERCEPTION OF THE FUTURE FOR PC/PCM COMPANIES

- Of the vendors interviewed, 40% felt that the market was increasing, that they would fill in the IBM gaps, and that the business would go on forever.

  - Some vendors believe they must be in the systems market offering end user applications.

  - Others felt that the market was shrinking and in order to be a viable business they had to expand product offerings to include more software, peripherals, and specialized expertise.

- There was no clear cut direction that the vendors were following to retain their position as a viable alternative to IBM. The vendors action plans, in order of mentions, were:

  - To achieve better price/performance.

  - To improve service and support.

  - To offer software as well as hardware solutions.

  - To improve production to meet demand.

  - To remain compatible wherever and however possible.

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- When the respondent vendors were asked, if the present market situation were projected accurately five years ago, would they be in the business today, 75% said they would.

  - Given the on-order situation of some of those firms surveyed, it is difficult to share their feelings on the viability of the PC/PCM business.

- The respondent vendors were split 50/50 on the issue of a software lockout by IBM due to the implementation of a hardware/firmware/software combination that would make utilization of IBM systems software on non-IBM mainframes impossible.

  - However, 86% of the vendors believed that the PC/PCM business was evolving into a system sale and not just a "box" sale.

- Vendors were asked to forecast specific new IBM announcements. In order of frequency of mention, these were:

  - "H" Series.

  - New 8100 software/applications.

  - Modified 3370, offering 1 billion bytes per spindle.

  - High performance, reel to reel, streamer tape.

  - Intelligent terminals.

  - Relational DBMS.

  - Data base management back end processor.

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- The vendors were asked about the future of PC/PCM companies in view of the recent IBM announcement and the new pricing levels.

  - Fifty percent were negative, 18% were positive, and the rest believed they were in a holding pattern, fighting for survival.

  - Typical comments were:

    . "Only balanced companies can survive."

    . "Companies must offer a broad product line."

    . "Can no longer compete as 'box sale' or just on price replacement."

    . "Must offer a complete system with software and not just the PCM."

    . "Need to establish better marketing and service and become a factor in the end user market."

  - Needless to say, all the vendors were sure that their company would survive and it was the "other guy" who was in trouble.

- The vendors were asked who was the best viable alternative to IBM other than themselves. The most mentioned companies were:

  - CPUs: Amdahl, Two Pi, Magnuson.

  - Disk Drives: STC, Memorex, CDC.

  - Tape Drives: STC, Memorex.

  - Printers: Documation, CDC, Xerox.

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- Terminals: Wang, Datapoint.

- The vendor responses closely paralleled those of the users.

  . One area of difference cencerned Itel. Users believe Itel had offered a very viable alternative to IBM. Only one vendor felt that Itel Data Products Group (now National Semiconductor Advanced Systems) offered a viable alternative.

- A majority (57%) of the vendors did not believe that another industry "shake out" was coming.

  - There was general belief among the vendors that some consolidation via merger, acquisition, or joint venture would occur as companies moved to create a more balanced operation and broaden their product offerings.

- Vendors perceived their advantages over IBM from different views, depending on their product line.

  - The PCMs cited their advantages as:

    . Delivery.

    . Price.

    . Features.

  - The PCs cited:

    . Price.

    . Reliability/availability.

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  - Delivery.

- While the software firms stated:

  - Ease of use.

  - Efficiency.

  - Performance.

- While users said that price was not a prime buying motivation, the vendors still believe that a price 15% to 20% less than IBM's is a requirement.

- The vendors were asked their perception of what factors most influenced users' hardware selection. The responses, in order of number of mentions, were:

  - Service.

  - Support.

  - Price.

  - Company reputation.

G. RESEARCH AND DEVELOPMENT EXPENDITURES

- One of the most oft-quoted reasons given by users for PC vendors' ability to sell at prices lower than IBM is the one about "PC vendors expenditures for R&D are much lower than IBM's."

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EXHIBIT IV-3

RESEARCH AND DEVELOPMENT
EXPENDITURES BY
PLUG COMPATIBLE MANUFACTURERS

COMPANY NAME	FISCAL YEAR	TOTAL REVENUES ($ MILLION)	NET INCOME ($ MILLION)	R & D EXPENDITURES ($ MILLION)	PERCENT R & D EXPENDITURES TO TOTAL REVENUES
AMDAHL (FYE 12/31)	1977	$ 188.8	$ 36.3	$ 16.7	8.9%
	1978	320.9	48.2	24.6	7.7
MEMOREX (FYE 12/31)	1977	450.1	55.9	19.2	4.3
	1978	633.3	50.2	23.6	3.7
STORAGE TECHNOLOGY CORP. (FYE 12/31)	1977	162.3	11.4	9.2	5.7
	1978	300.4	26.8	18.9	6.3
TELEX (FYE 3/31)	1977	119.3	6.3	2.8	2.3
	1978	140.5	8.5	5.1	3.6
	1979	148.2	5.4	7.6	5.1
IBM (FYE 12/31)	1977	18,133.2	2,719.4	1,142.0	6.3
	1978	21,076.1	3,110.6	1,255.0	6.0

NOTE: DATA DERIVED FROM FORM 10KS.

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V IBM STRATEGIES, TRENDS, AND FORECAST OF ACTIONS

V IBM STRATEGIES, TRENDS, AND FORECAST OF ACTIONS

A. INTRODUCTION

1. GENERAL COMMENTS

- IBM will make it increasingly difficult for PCs and PCMs to compete over the next several years.

  - Beginning with the 8100 and followed by the 4300, IBM has leapfrogged into the forefront of new technology, making it very difficult, if not impossible, for PCs and PCMs to achieve a technological advantage over IBM as they have been able to do in the past.

  - INPUT believes there are many new announcements to come, including:

    . Two more models in the 4300 series.

    . "H" Series, high-end machines - at least four separate models.

    . A new family of rotating magnetic memory devices with four times the density and several times the transfer rate of any of today's disk drives.

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- Major portions of the operating system (MVS in the "H" Series) will be implemented in firmware.

- The "H" Series will be announced together with a new relational model data base management system (called System/R), which will largely be implemented in firmware.

- Documentation on new machines and software, including the System/38, 8100, 4300 and "H" Series, will not be released until first customer shipment. Even then, IBM plans to release documentation only to the customer.

- Although IBM operating systems are supposed to be in the public domain, the software/firmware implementation will make it extremely difficult to copy.

• With very little competition facing it in the PC and PCM area, IBM will pursue an aggressive pricing strategy which will emphasize the "pay for what you use" philosophy. That is, IBM will price all aspects of a system separately including hardware, software, software support, and maintenance.

- IBM recognizes that the most value-added (profit) will come from support, rather than hardware, sales. Hardware will be relatively inexpensive. Software and support, including maintenance, will be very expensive.

- PC and PCM vendors that emphasize hardware will find it difficult to compete with this pricing strategy.

• The U.S. Justice Department has clearly relaxed its attitude towards IBM's potentially monopolistic position.

- IBM has won every private case in court (i.e., Greyhound, Memorex, Telex).

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- IBM exports account for a major portion of the U.S. balance of payments offsetting foreign oil imports. The government is not inclined to disturb this situation.

- IBM will not, as a matter of policy, enter into any technology exchange agreements as they had previously done with Amdahl. IBM would make an exception only in the event that the agreeing party could clearly demonstrate that it had a superior technology that IBM could use, such as the recent joint venture with MCA on video disk.

- All 4300 series and impending "H" Series machines will be fully software compatible with 370 class systems as far as applications software is concerned.

  - Users will not accept any system that will not run existing applications software.

  - Existing 370 systems software will run on new IBM systems. However, further development of existing systems software (for example, IMS) could be frozen. All new development work will be directed toward new systems that will take advantage of the firmware microcode capabilities of the 4300 and "H" Series. Thus, while the old system software will run on the new machines as well as the old, new system software will run only on the new machines.

- IBM's maintenance policies will be flexible according to the customer. For large customers, IBM will be more cooperative, vis-a-vis PCMs, than for small ones.

  - IBM will not maintain any equipment other than its own systems.

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- Systems software maintenance and hardware maintenance are now integrated into one division organizationally at IBM. Because of the increased reliability of the new systems, the maintenance focus will increasingly be placed on software.

- Reports from IBM senior personnel lead INPUT to believe that IBM fears Japanese competition in its markets more than that of would-be American or European PCs or PCMs.

  - It can be rationalized that the present strategy implemented by IBM to achieve profit from software, maintenance, and service as opposed to "pure iron" is aimed more directly at the Japanese and not as directly to domentic PC and PCM manufacturers. However, the domestic companies will feel the results of this action.

- IBM is committed to the success of SNA.

  - The coming battle between IBM and AT&T will be decided by IBM's capability to sell, install, and protect SNA as the ultimate network architecture.

  - With the announcement of the 8100, IBM created the capability for users to implement SNA without a host computer.

- Users are confused as to what to expect next and, due to an elongated delivery schedule for new IBM hardware, have placed "position orders" to assure a slot in the production schedule.

2. PLANNING AND PRICING STRATEGIES

- The projections given in this section are based upon logical analysis of IBM's past performance, coupled with INPUT's informed opinion of data derived from current and former IBM employees, professional product marketing analysts, and computer design and marketing consultants.

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- It should be noted that IBM's top management may approve a computer strategy. However, only five people finally approve a product pricing announcement. Thus, it is very difficult to know precise pricing in advance.

- The "E" Series (4300) pricing was lowered in late September 1978. IBM needed large order volumes to justify the lower prices. Internally, the IBM product manager has full responsibility for market planning, product specification, design, manufacturing liaison, and financial planning. This last function is subjected to continuous review by IBM's top management. Every IBM product plan is expressed as a "mini" business plan examined by computerized financial modeling. The product financial model then interacts with all other IBM product financial models. These then work against both the IBM corporate financial model and IBM's global economic model. Conceptually, you can view these as four levels of DO Loops in a FORTRAN program, or as four subroutines:

  . Proposed product plan financial model.

  . Adjacent products' financial models.

  . IBM corporate financial model.

  . World econometric model.

- Antitrust and predatory pricing concerns for new products are handled by a system which pressures the product manager to increase sales volume forecasts and to lower prices.

- Sales prices are not just purchase prices. Sales prices are: monthly rental prices; two year lease prices (15% lower); hardware purchase prices with rental credit considerations; maintenance pricing with various levels of service and responsibilities; software license fees, both one time use and maintenance;

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and field software support pricing. Typically, peripheral products and software have longer "lease revenue lifetimes" than hardware. This is because IBM rarely reduces monthly rental prices as equipment ages.

- The theories and forecasts for the "E" and "H" Series were tested in advance by applying the same algorithms to 8100 and System/38 pricing:

  . Low memory prices per 1 MB.

  . 4331 and 370/138 processing power (.25 MIPS) for $50K.

  . New price/performance of disks - 2:1.

  . New price/performance of CPU and memory - 5:1.

  . Maintenance pricing - 33% for same computing power.

  . New peripherals slightly more profitable to IBM.

  . Significant software unbundling and profits.

  . Greater customer responsiblity for software support.

  . Relational DBMS on System/38 uses special nano memory.

  . Query language on 8100 and System/38 for users, not programmers.

- The 8100, (project Orbit) was originally conceived as a replacement for the 3790, as well as a vehicle for Satellite Business Systems (SBS). During the summer of 1978, IBM's top management kept forcing the 8100 product manager to lower his pricing algorithms, increase forecasted volumes, and still maintain original profitability levels.

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Expanding the software offerings and charging more for them permitted abnormally low CPU and memory pricing.

  - Engineering and manufacturing complained that they could not hit the required memory yields and manufacturing costs until mid 1981.

  - Software development programs were increased and planned delivery dates moved forward. These extra costs were written off against considerably larger forecasts.

  - IBM top management never directly said: "Let's engage in predatory and forward pricing." Rather, they pushed the product manager through many iterations to emphasize software pricing, low manufacturing costs, and large volumes.

- IBM's SNA had always presupposed a central 370 until the 8100 announcement.

- The 8100s are able to communicate with each other and build a distributed data processing (DDP) network with no host (no central 370). Since all large companies have central data processing facilities, these 8100 users will initially communicate with centrally located files. A new DP user could, in theory, get along with no host and multiple 8100s.

  - Large companies can put together an information processing strategy and provide for migration of some files to physically distributed 8100 locations.

  - Datapoint, Sycor, Tandem, and others now can point to IBM's benediction of DDP.

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- IBM's offensive strategies are:

  - Lower pricing through parts commonality and high volumes.

  - Much use of microcode for I/O search and compares, which enhances performance and also discourages attachment of non-IBM controllers and peripherals.

  - Lower ratio of lease to purchase prices (now 32:1: was 40:1), thus encouraging end users to purchase, not lease.

  - Operating systems software beyond and outside the public domain.

    . IBM has made the System/38 package relatively hard to emulate. All programmer addressing is virtual. All I/O control, (logical to physical address translation for main and auxiliary memory) is completely under the control of the service control program. No assembler language will be released. There will be no field releases of: Principles of Operations, Theory of Operation, microcode, micro diagnostics, or fault isolation diagnostics within printed circuit boards. If someone reverse engineers the System/38 and its peripheral controllers and disks, the software will still cost $500/month payable to IBM.

  - IBM's Data Products Division regards General Systems Division's System/38 as a competitor to 4331 and 8100. System/38 appeals to current System/3 and System/34 users who want a logical upgrade. IBM will keep these relatively unsophisticated customers far away from any knowledge of System/38 logics.

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3. IBM MARKETING

- While IBM generally profits by confusion in the marketplace (or at least is impacted less than its competition), intra-organizational "competition" can be not only embarrassing, but counterproductive. The DPD/GSD/OPD competition within IBM may confuse the marketplace, but from IBM's point-of-view, it is probably perfectly clear.

  - DPD will work at the traditional task of servicing large corporations.

    . At the low end of DPD's market, standalone systems will continue to be sold and "grown" in its time honored tradition (4300 Series).

    . In all companies, processing and storage will be distributed to smaller and smaller organizations within the enterprise.

    . As individual offices of large companies are penetrated, the distinction between DDP and office automation becomes hazy. DPD will have no hesitancy in replacing word processing systems, or even typewriters, with clustered terminals under SNA. This is the "right" thing for big customers with 30XX, or later, "H" Series equipment installed.

  - GSD will concentrate on smaller companies, which may be first time computer users.

    . They have significant growth possibilities within their own product line and will be permitted to exploit this.

    . Support for process control and servicing sensors is a market that DPD should be happy to leave with GSD.

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- If there is an attitude in GSD that large systems may not be necessary when DDP reaches its ultimate implementation, it will be condoned; but products (advanced storage systems) and support (total systems software) will be restricted.

- GSD can bring technology and systems experience to their sister division, OPD, within the framework of the General Business Group.

- If GSD discovers the requirement for a small company to interconnect with a large company or companies (for example, independent insurance agents with major insurance companies) they can provide connection under SNA to DPD systems.

- OPD, of course, has been marketing in the office environment in all size companies. All offices are essentially first time computer users regardless of how much hardware the "DP department" may have installed.

  - As processing power and storage is packaged into OPD products, there will be an orderly and evolutionary approach which will retain operational characteristics familiar to office personnel.

  - Technology will be down-played and programming will be an anathema.

  - As new multifunction equipment becomes available, it will be combined with GSD and DPD systems. Those divisions will have responsibilities for communications interconnection. This will represent "good business" for the OPD salesmen since DPD and GSD salesmen will probably do most of the work on mass orders and yet OPD will have exotic new products to confound competition and penetrate new areas.

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- From the IBM corporate point of view, they are approaching an enormous potential market at both extremes and in the middle. No other company is really able to do that. A little confusion and internal competition may result, but it appears to make good financial sense and certainly eases the management burden.

B. IBM 4300 STRATEGY AND STATUS

- Vendors who compete with IBM in the mid-range mainframe arena have received some clarifications of the price/performance targets they must achieve to be viable alternatives.

- In an internal announcement, IBM highlighted the 4300 series under the heading of "Systems For The Future." When they publicly unveiled the first two processors in the long-awaited "E" Series on January 30, 1979, the announcement was greeted by the industry with considerable attention, since IBM claimed that this was their fifth major step in computing from the time the company entered the market in 1953. Previous landmarks introduced at approximately five year intervals have been:

  - The 1401 second generation machine.
  - The System/360 and OS.
  - Virtual Storage (VS).
  - SNA.

- INPUT had previously issued forecasts of the announcement in its Vendor Watch Report of June 1978, "The Future of IBM Mid-Range Systems," and in a special letter to clients entitled "An Evaluation of Likely Announcements."

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- The two new processors are the 4331, the smallest of the "E" series processors developed, and the 4341, the second largest of those developed. The third and fourth processors in the series have yet to be announced.

  - INPUT believes that the third and fourth processors will be announced by the end of the second quarter of 1980.

  - However, due to the initial success of the 4331 and 4341, IBM could well delay any other systems in the 43XX family.

- If one notes the on-order charts referred to in "User Survey Analysis" (Chapter III of this report), it is obvious that IBM has little fear of losing their marketshare of medium range systems to PCMs.

- Both machines fall into the category of small to medium-size mainframes.

  - The 4331 has a reported MIP rate of up to 1.3 times the System/370 Model 135. It is available with twice the storage and four times the power of the Model 115. It, therefore, replaces and obsoleces the System/370 Models 115-2 and 125-2 and their earlier versions, and has some overlap with the top-of-the GSD line - the System/38.

  - The 4341 (with a quoted MIP rate 1.7 times that of System/370 Model 148) has approximately three times the power of the 138, which it makes obsolete, together with the older 135 and the 148 itself.

- At the same time, IBM has introduced a new pair of disk drives. The fixed disk concept has farther reaching implications than the fixed recording mode, which nevertheless will present huge format and conversion problems to some users, since the fixed block mode does not accept either ISAM or DAM as access methods.

- By offering either DOS or VM, or DOS under VM, IBM is, in effect, pushing users towards VM, which makes admirable sense.

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- VM is a user oriented operating system.

- VM can host both DOS/VSE and OS/VSI.

- VS increases processor usage by both system and applications software.

- VM is a staging post between VS (virtual storage) and VP (virtual processor of "H" series).

- VM complements the "black-box," "easily implemented" approach to 4300 sales.

- New software actions by IBM are:

  - Packaging preconfigured system software sets, pretested in the factory for immediate "load and go" after hardware installation. Presumably, this will do away with multiple system generations.

  - Supporting system software post-sales by a national telephone answering system which accesses a relevant specialist, who then can call back the user with verbal fixes over the telephone. Any on-site follow-up visits that may be required generate additional revenue for IBM by monthly software maintenance fees or by hourly charges.

- The one missing enhancement in the announcements is any upgrade to data base facilities. DL/I has been selected to carry the data base flag until an improved IMS-level data base can be used.

- From a configuration standpoint, the recently announced DPD products may shed some light on the product line strategy.

  - The 8100 is configured with the processor and disk bundled into one unit as the base model.

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- The 4331 is configured with all the required adapters for disk, printer, tape, etc., in the CPU.

- The 4341 has external adapter/controllers. The disk file controller is faster and more expensive than the mainframe, leading one to believe that it contains more "goodies" than have been announced thus far.

- One could therefore speculate that for low end machines, where the software is rather simple, the "lock out" comes from bundling of hardware and functions. Where the software is complex, the "lock out" will be distribution of some software functions to intelligent controllers. (In this instance one chip change could preclude operation of PC equipment. Thus, PC vendors will have to provide all of the "distributed software boxes" to use the systems software.)

• From a marketing strategy, the 4300 range is cast as a general purpose workhorse replacing the 370s and extending data processing throughout organizations that have previously concentrated on a single mainframe serviced by a centralized DP department.

- In a distributed processing environment, there are subtle differences between the 8100 and the 4300. The 8100 was intended as a satellite processor while the 4300 was designed principally as a host. The differences between the host and satellite approaches are ones of:

  . Size and processing power.

  . Mainline operating systems as opposed to specialized and limited program products.

  . Centralized systems development (on the 8100s) versus distributed systems development (on the 4300s).

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- No doubt the DPD salesman will propose 4300s as satellites. If he "strikes out" he can always "double back" with a less costly 8100.

- The development of LSI technology has had two profound effects on computing:

  - Central processor prices have tumbled dramatically.

  - It has become economic to distribute intelligence into peripheral units, thus enhancing their capabilities.

- There are two implications for IBM (and other mainframe vendors as well).

  - Each price cut lowers the previously predicted revenue forecasts, and this revenue has to be won back from some other source.

  - As intelligence is distributed to peripherals, their capabilities can be enhanced and more sophisticated and ambitious configurations can be attempted.

- Basic ways of making up for previously budgeted revenue include:

  - Selling more complex units.

  - Selling more complex configurations.

  - Selling more units.

- With the 4300, IBM is committed to all of these techniques, and most especially to the third.

  - Selling more complex units and configurations has been proceeding continually, partly by means of extensions and replacements to the DPD

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catalogue and partly by increasing the number of users with capabilities, such as data communications and data base.

- The analysis of the on-order systems in the " Medium Range User Survey"(Chapter III, Section B of this report) reflects a large number of 43XXs on order with a minimum amount of disks, etc. In addition to the explanations offered in that sector, it could also be concluded that:

  . These are simple replace systems where multiple systems are to replace one system.

  . These are complex systems with specific configurations to be firmed up later.

- Regardless of the marketing approach or lack of detailed information on new software, IBM has set the stage for PCM vendors with new aggressive pricing.

C. IBM 8100 STRATEGY AND STATUS

- An analysis of the 8100 reveals that it is most likely a "compromise product" which was designed initially to provide the speed and power for DDP (specifically DPPX) but was reduced in capability for announcement.

  - Due to a series of internal hardware changes, it is doubtful that it has the throughput power to handle a large number of terminals and cope with the DPPX (Distributed Processing Program Execution) system overhead, without severe response time degradation.

- The 8100, in its present announced configuration, can be sold as:

  - A standalone minicomputer.

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. However, in this market, it will face stiff competition from the more traditional manufacturers of minicomputers.

. It is not a powerful machine and is not supported by the typical IBM RPG package, nor is it offered with applications support.

- A cheaper, better, faster compatible 3790 replacement.

. This appears to be where most of the orders have originated.

- A DDP device, supported by DPPX as a small 370 system.

. Considerable user programming is required to implement DPPX. Therefore, once installed, it will be a difficult device to displace.

- Early marketing concentration for the 8100 will be on current 3790 users and prospects. This will solve some of the problems associated with the 3790 and provide easy installation under DPCX (Distributed Processing Control Executive).

- Major industry segments will be selected for joint development of application software to run under DPPX.

- DPPX installations will be encouraged to maintain strong central management control and distribute only data entry and editing functions.

- Individual locations will be encouraged to buy two 8100 systems ("they're cheap") - one for running current work and one for implementing new applications. If additional justification is required, backup will be stressed.

- The DP sales force will sell the 4300 in preference to the 8100 whenever possible. Customers can always surround the 4300s with 8100s used as cluster controllers.

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- Nearly the entire sales effort will be concentrated on large users. The DPD sales force will not go out after the first time user even though they now have a potentially competitive product. They want to sell large orders and leave the small sales to GSD.

- There will be an early emphasis on manufacturing companies because of the size of the market, the integrated systems capabilities, and experience. This could lead to later penetration of small manufacturing companies (once software is developed).

- However, despite DPD's orientation towards the computer room, the future lies in the office environment. When typewriters become terminals, DPD wants to be there. When it runs out of old 3790s (3730s), look for word processing capability on the 8100.

- In addition to the joint industry applications development efforts, look for early general purpose application support packages.

  - While IBM has not been noted for success in this area, the time is ripe for it and the money is there.

  - In the distributed environment, performance becomes somewhat unimportant since processing power is so inexpensive. Users will not be so demanding as long as it works.

  - This approach permits centralized purchasing of packages and distribution which will enhance control.

  - It has to be more economical since individual locations cannot afford to hire programmers.

  - The 4300 series will provide practically all data base and batch services required in a large office building.

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- The 8100 communications control, will control all communications within the building, with the large scale (H-Series) host, and with other nodes.

- An 8100 with the 3644 Automatic Data Unit will control energy consumption, run elevators, provide building security, fire control, etc.

- 8100 loops for word processing and information flow (data base) will be installed as required.

- The loops support all current and future office and data processing devices: printers, CRTs, intelligent copiers, etc.

- Communications with the host or other nodes may warrant the use of Satellite Business Systems, depending upon the size of the node.

- The potential office automation market is so large that IBM cannot afford to risk leaving the entire responsibility for development and marketing to the General Business Group. The 8100 signals recognition that data processing, communications, and office automation are all merging. DPD will have a very definite edge for this market in large corporations.

D. LARGE SCALE SYSTEMS STRATEGY AND STATUS

- While the IBM status and strategies are defined in the low end market (System/38), the DDP market (8100) and medium range market (43XX), the high end systems market is still a question mark.

- Over the past several years IBM spread a "price umbrella" for large scale systems (except scientific machines) that allowed competitors to price a comparable product under IBM and yet yield a profit.

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- In addition, as OS, IMS, etc., matured and expanded in size and complexity the competition (which traditionaly had superior software) could out-perform IBM.

- In spite of the handicap of poorer price/performance, IBM was able to control the large systems market (System 370 Model 158 and up).

- This situation remained intact until the advent of PCMs, such as Itel, Amdahl, etc., began to encroach on this market with less costly, but better performing, equipment.

  - IBM countered these startups with a series of minor moves involving price adjustments and other non-threatening software strategies.

  - Even major announcements such as the 30XX family was taken in stride by the competitors. In fact, the market expanded due to better price/performance and everyone (including the user) benefited.

- The announcement of the System/38 was not considered a threat, but this, followed by the 8100, began to "paint a darkening picture" for PCMs as new levels of computer power for the dollar began to take form.

- The announcement of the 43XX served notice that the PCMs were in for "rough sailing" in the future.

  - The aftermath of this announcement produced several major price cuts, announcements of new products, and altered the shape of the medium range CPU market.

- Now the industry awaits the much discussed "H" Series which is to shape and set the standard for the high end of the systems market.

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- Prior to the major announcement, IBM normally implements strategies to lessen the blow on its own products, which, due to sheer volume, are the biggest victims.

  - In June 1979, lease prices on 30XX were increased about 5%.

  - November 1, 1979, IBM reduced the purchase price of 30XX by 15-21%.

  - In the same package was an incremental memory price reduction from $75,000 per megabyte to $50,000 plus an upgradeable "Group N" machine.

  - These moves were made to increase purchases, protect the backlog, bring the 30XX in line with recent announcements, and prepare for the "H" Series.

- These announcements have done little to affect competition. (In fact, one stock brokerage firm has stated it was good for Amdahl, which reacted with price reductions and an upgradable machine which in turn, stimulated purchases and provided cash).

- From an external view, IBM is now positioned for the "H" Series announcement.

  - Most industry sources and PC/PCM vendors have placed this date as prior to June 1980, or approximately six to nine months after the announcement of the "Newport Project" which occurred in November 1979.

- Internally, IBM may not be ready for the "H" Series.

  - There are some production problems associated with the 3370 disk drive, which no doubt will delay some 43XX shipments.

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- The 64K chip production is either experiencing yield or volume problems, since IBM has quietly announced that "certain products will be shipped with 16K chips and that individual customers will be notified of the change in their configuration."

- Problems with the new data base system on System/38 (relational techniques are easier to implement in small scale data bases) has caused deliveries to slip significantly. (First customer ship is now scheduled for June 1980.)

  . The long suffering large scale users who have invested huge amounts of monies to implement IMS will want to see a clear cut, well defined, plan to migrate to the new system. Others will want to see a new data base system that is easy to install before they will order. No doubt the data base for System/38 is now working, so the debate for the large systems is not "what is it?", but how to implement and migrate.

  - Based upon the rumored 30XX backlog and lack of any serious competitive threat, on the surface, it would appear that the "H" Series could be delayed without endangering market share.

- The price/performance of the "H" Series will lie on a curve equal to the 43XX. This is not the most important aspect of the new system!

- Most important will be "H" Series' data base support and implementation method.

  - The announcement of the new technology disk drives that coincided with the 43XX announcements have set the stage for major improvements in data base capability that will accompany the "H" Series.

  - The single level storage concept of the 4300 Series under native mode (which appears to be the same as that of the System/38) paves the way

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for user oriented development of applications that access data by content rather than by address. The 3880 disk control unit announced for the 4341 certainly has more capability built into it than has yet been divulged, and probably includes (in firmware) the capabilities of a "hardware sort box" and a "back-end processor," including the system dictionary. It operates twice as fast internally as the 4341 and costs almost as much as the 4331.

- "System R," IBM's relational data base, has been in use internally for some time, but has been plagued with performance problems. It is doubtful that IBM can afford to offer another software package like IMS. This time there will not be enough software engineers to go around and hold hands, and so the software must be reasonably clean the first time out. Extensive use of microcode combined with off-loading of intelligence directly to the storage device has been the implementation strategy, and appears to provide a working solution for medium sized (50-500 megabyte) data bases on the System/38. Now, the objective is to make it in the 1-10 billion byte range, a larger problem.

- When the new data base system is announced, it is likely to be at least partially implemented in firmware on the "H" Series, but a full software version will be offered to 370/303X users to provide a migration path. The difference in performance will provide a strong motivation for users to upgrade to the "H" Series.

- Other items regarding the "H" Series are:

  - The type and form of its communications front end. The 3705 is "tired iron" and not an adequate vehicle for a powerful host CPU in a communications environment.

  - The type of mass storage system that will merge tape and disk into a workable storage hierarchy required to handle DDP.

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- The embedded systems software/firmware and its distributed location as a method to lock out PCMs and force them to develop their own operating system.

- Indeed, if IBM addresses these important issues and provides adequate solutions, PC/PCMs will have a formidable task to remain competitive.

E. IBM PERIPHERAL STRATEGY AND STATUS

1. GENERAL COMMENT

- In order to understand IBM's strategy relating to peripheral devices, it is first necessary to understand the shift in revenue away from processors and toward peripherals, software and service (including maintenance). As recently as five years ago, a rule-of-thumb estimate would have been that processors and main memory accounted for 50% of systems cost. Today there is a dramatic change in revenue percentage away from main processors, which, in many cases, accounts for less than 20% of the hardware costs.

- IBM is very much aware of the technological trends underlying these revenue shifts. Past experience, however, would indicate that IBM's strategy will probably be to slow technological change if it maximizes profits.

  - When System/360 was announced, the performance of the processors was restricted by limiting the amount of main storage available on the various models. If more storage was required (frequently to run IBM software), it was necessary to upgrade the processor, not because the processor was out of power, but because of arbitrary memory restrictions.

  - A present day example of extending processor life and controlling technology is the 3705. Customers requested disk storage when the

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3704 was announced over six years ago and have continued to plead for a state-of-the-art communication front end ever since. However, the 3705 remains - primarily because it is a profitable device.

- Advances in technology cause shifts in revenue sources. IBM's approach is to manage technological change in order to maximize profits. Moreover, it can force technological obsolescence when the time is right.

- Despite a series of IBM announcements indicating dramatically improved price/performance, it is doubtful that there will be any significant change in its traditional business approach. Therefore, in order to determine the strategy related to peripherals, it is necessary to isolate the areas where:

  - The advance of technology can be most effectively managed.

  - The particular technology permits other systems components to be controlled.

  - There is sufficient revenue to make a contribution to IBM's growth objectives.

  - There is the potential for massive forced obsolescence.

2. DISK STORAGE SYSTEMS

- Rotating magnetic disk memories have been the primary mass storage media in use since System/360 was announced, despite IBM's attempts to develop other high volume storage technology.

  - Prior to the announcement of System/360, IBM completed preliminary work on a promising mass storage system based on "tape loops" but reliability presented a problem.

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- The Data Cell was announced with System/360 and provided inexpensive mass storage, but it too had reliability problems and was withdrawn from the product line. (Actually, the device had a proper place in the storage hierarchy, but it could not stand the wear and tear when substituted for disk in frequently accessed data applications.)

- Currently, the Mass Storage System (3850) provides up to 472×10^9 bytes at a cost of .000063 cents per bit. However, performance and reliability problems have plagued the system.

- The point is that IBM has been trying to develop massive, cheap, on-line storage; however, disk storage still prevails and its cost has gone from $0.04 per bit in 1964 (2311) to $.0005 - $.00077 per bit in 1979 (3370, B1 and A1). This means that the cost of disk storage is less than 2% of what it was 15 years ago.

  - The next order of magnitude of improvement in high performance, reliable mass storage costs is extremely important. At $.00005 per bit, it can be clearly demonstrated that storing data and information on-line is cheaper than paper.

  - This is possibly true at present with the MSS 3850 at $.00006 per bit, except for reliability and performance problems. Tape drives cannot be removed as rapidly as promised and additional disk storage required for staging substantially increases the true MSS cost.

- IBM's desire for inexpensive mass storage supports their System Network Architecture (SNA). Either IBM truly believes in the enormous central data base which it claims will exist someday, or it does not really support distributed data processing (DDP). However, one thing is certain: IBM does believe in large host computers and has been successful in selling them. Large central computer sites have operational problems if large numbers of tapes must be mounted and the MSS was sold on the basis of reducing operational costs and problems due to magnetic tape.

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- However, it is a fact that when one technology becomes obsolete it remains installed during conversion periods which are almost always extended. Just the physical problems of loading massive storage systems is far from trivial. Even without considering systems conversion, the problem of back-up remains. Therefore, cheap mass storage systems which can replace tape libraries will increase IBM's revenue.

- Another systems aspect of having inexpensive mass storage is the tendency to reduce paper output. It will eventually be economically feasible to maintain even archival information on-line and have ready access to it. However, printers will tend to remain installed because this will represent an even more difficult systems conversion than magnetic tape, because it impacts the end user's interface to the system. In addition, for users to have ready access to historical information, they must have either CRT or hard copy terminals.

- INPUT believes that, while inexpensive mass storage may eventually impact tape systems and centralized high speed printers, the immediate probability is relatively low. Lower speed printers and CRTs will more than compensate for any long term impact.

- In addition, inexpensive mass storage is also essential for storing information which will be distributed in the "office of the future."

  - Central "filing" of correspondence, memoranda, images, technical documents and publications with ready access will soon be possible.

- Traditional fascination with processor price/performance is misplaced. In fact, a strong argument can be made that intelligent storage systems will become the central portion of systems, and that processors will become peripheral devices.

- Inexpensive mass storage is required at all levels of the processing hierarchy. Not only can it be the critical factor in systems design but it can be used to

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control both the application of processor technology and implementation of SNA.

- Current disk storage technology has the "advantage" that it will eventually become obsolete and subject to replacement.

- Based on IBM's traditional hardware marketing tactics and strategies, mass storage appears to have many advantages as the focal point for both hardware revenue production and effective control of computer/communications network development. There are indications that IBM is pursuing a "storage oriented" strategy which will probably become more apparent in the early 1980s.

- The present trends in IBM's peripheral strategy can be more clearly appreciated by examining the 8100 and 4300 peripheral devices.

- As such, it is important to analyze the potential distribution of hardware revenue for the 8100 and to assess the possible peripheral strategy in the context of SNA.

- On the 8100, the first thing that becomes obvious is that classic concepts of "peripheral" have become somewhat confused. "Processors" come in various models based on main memory and disk storage. The price of the processor includes various combinations of the following:

  - 1 MB diskette (all models).

  - 131 KB fixed head disks.

  - Up to 64 MB movable head disks.

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- On the smaller 8130 processor, the actual cost of the built-in disk storage is probably greater than the cost of the CPU and processor storage. By any logical definition, the 8100 "processor" is a complete hierarchical storage system. A major peripheral component has been bundled into the processor.

  - If additional mass storage is desired, the 8101 storage and I/O unit must be added (up to two on the 8130 and four on the 8140). The 8101 is a separate controller which can control additional peripherals (printers, card readers, terminals, etc.) either directly or on an attached loop basis, plus additional communications attachments. The additional disk storage is built into the device.

    . The 8101, Model A10 (without disk storage) costs $6,500.

    . The 8101, Model A13 (with 64 MB of disk storage) costs $16,410.

    . Therefore, the cost of disk storage on the 8100 systems is approximately $9,900 for 64 million bytes or $.0091 per bit. (If there is no need for the 8101, other than additional disk storage, the cost becomes $.0032 per bit.)

    . It is possible to have up to 320 million bytes of disk storage on the 8140 (64 MB in the processor and four additional 8101s with 64 MB each). This means that the cost of maximum disk storage could be between $49,550 and $82,050 depending upon how the base price of the 8101 is accounted for.

  - While bundling disk storage has tended to confuse the issue, it is possible to obtain a rough estimate of processor and main memory costs by subtracting the cost of disk storage.

    . The 8130, with 256K (64K bit chips), would be approximately $16,000 (including console and diskette).

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  - . The 8140, with 512K (conventional technology), would be approximately $37,700.

- "Typical" configurations of the 8130 and the 8140 are approximately $90,000 and $180,000, respectively. This means the processors represent only 18% and 21% respectively of the total hardware costs. In addition, there are other facts which should be noted:

  - . Disk storage on both systems can cost substantially more than processors and main memory and this storage is three to five times as expensive as recently announced technology.

  - . The cost of printers on both configurations exceeds the cost of the processors. On the 8130 configuration, the cost is $26,070 (one line printer and two 120 CPS printers) compared to the $16,000 processor cost. On the 8140, the cost of printers is $38,890 (one line printer and four 120 CPS printers) compared to the estimated processor cost of $37,700.

  - . The cost of a magnetic tape unit recommended for backup of mass storage is over $12,000.

  - The importance of peripherals on the 8100 is apparent, and by bundling relatively expensive disk storage into the procesor and the 8101 I/O controller, IBM has made it more difficult for both disk and processor plug compatible vendors.

- The 4300 Series established a new IBM price/performance standard for both processors and disk storage.

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- The 3370 disk storage which prices out to between $.00077 and $.0005 per byte, established a new IBM standard for disk storage, which makes it roughly competitive with the CDC 3350 plug compatible replacement announced in September 1978. The CDC disk storage prices out to $.00058 per bit.

- The 3310 disk storage unit, which was announced for the 4331, prices out at $.0025 per bit which places it in the mid-range of the 8100 disk storage costs ($.0019 - $.0032 per bit).

- The total disk capacity, using the 3770, is 9,136 million bytes on the 4331 and 18,272 MB per control unit on the 4341. Therefore, while a large 8140 configuration may cost as much as a 4331, its application is limited by having only 3.5% of the potential mass storage capacity. This confirms the conclusion that the 8100 is intended as a 3790 replacement (essentially a cluster controller). It provides a good example of limiting the processing which can be distributed through control of mass storage.

- The availability of two new printers also assists in system differentiation between the 4331 and 8100. The 4331 is supported by the 3289 printer (400 LPM and available on the 8100), the newly announced Model 3262 (650 LPM), and the new 3203 Model 5 (1,200 LPM). The message here is that only limited distributed processing applications can be supported using the 8100.

- Whereas disk, tape, and communications adapters are integrated in the 4331, the 4341 has an intelligent disk controller (the 3880) which costs nearly as much as the 4331 processor and can operate at twice the speed of the 4341.

  . This can increase the true cost per bit of disk storage by over 50% on smaller configurations of the 4341. The 4331 with 3370s can actually provide raw mass storage at a cheaper cost.

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However, the 3880 controller is programmable and is probably a good indicator of IBM's future strategy.

  - From IBM's point of view, the 3880 creates complexity in making direct comparisons, even across its own product line. More importantly, IBM has stated that the 3880 may be upgraded by programming it for special applications in the future. The threat to plug compatible drives is obvious and it also provides a way for IBM to make obsolete its older drives as it sees fit.

- Unlike the 4331, the 4341 does not have an integrated communications controller; it still uses a 3705 type controller. (Another example of stretching out the life of high profit obsolete hardware?)

- The 8100 Information System and 4300 Series both give clear indications as to how IBM continues to use processors and peripherals to manage the release and application of new technology; sometimes arbitrarily, but always with a purpose. However, the future peripheral environment becomes extremely complicated as a whole new set of multifunction office systems begin to appear.

- IBM recognizes the desirability of on-line storage as compared to tape and is attempting to drive mass storage costs down to the point where tape storage (including physical handling) will not be the least expensive magnetic medium.

  - The strategy will be to de-emphasize tape systems except for archival storage and back-up.

  - Tapes will be available for a long time regardless of how little use is made of them (following the card syndrome), but even duplicate data bases on disk may be preferable to the procedural problems and costs associated with maintaining data on tape.

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- By the late 1980s the internal or external computer utility will provide "bonded data warehouses" and back-up for all distributed processing locations. Conventional magnetic tape usage will continue to decline; it is an "inconvenient" technology.

- "On-line" storage has been identified as the key IBM peripheral strategy in terms of both revenue and technological importance. As is generally known, there are currently at least three competing technologies: magnetic disk, charge coupled devices, and bubble memories. While the technology should be of little concern to the user, the fundamental characteristics are important.

  - The primary factor in reducing the cost per bit in rotating magnetic disk memories is areal density. Without getting too technical, it may be stated that the limitations on conventional magnetic disk recording will never be reached.

    . There is no intrinsic limitation to the lineal bit density in magnetic recording until the mean atomic density of 1×10^8 atoms per inch is approached. Even considering various physical problems, lineal density of 1×10^6 has been considered possible. Converted to standard terminology, this converts to an areal density of 1×10^{12} per square inch.

    . This "reasonable" limit will never be approached because it is improbable that track density can keep up with the theoretical maximum. There are obvious difficulties in following a spinning track with a magnetic head (regardless of technology). A reasonable estimate of the achievable number of tracks is 33,000 per inch. This leaves an areal density of approximately 3×10^{10}. Current densities are still less than 1×10^7.

  - The obvious conclusion is that there is still a long way to go for rotating disk memories before a practical physical limit is reached. Magnetic

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disks will continue to be the primary thrust of mass storage development through the mid-1980s. However, there are problems.

. Any electro-mechanical device presents not only physical limitations, but other problems regardless of how well they are engineered. As an example, they require maintenance.

. People costs are increasing and technological costs are decreasing. Therefore, maintenance becomes a critical factor. A vendor (such as IBM) would prefer to charge for maintenance and hope that the need for it never occurs (in which case the customer would also be happy). It is in the interest of all vendors to improve the reliability of technology and charge for maintenance based on past experience.

. This is the reason for sealed disk drives, and the reason that the disk will give way to other technology before the practical limits of rotating memories are reached, and before there may be any specific manufacturing cost justification for replacing the product.

- The most likely technology to replace magnetic disks for on-line memory systems is circular magnetic domain (bubble) technology. It has the following attractive characteristics:

  - While digital information still moves past a read/write point, no mechanical motion is required.

  - The "shift speeds" of bubbles are much faster than disk.

  - It is non-volatile (like disk, but unlike CCDs).

  - Eventually, it will be cost effective against disks on a bit-for-bit basis.

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- The range in cost estimates for bubbles is quite wide since there is a great deal of disagreement on how rapidly the market will develop (and IBM will influence that).

- Straight cost comparisons may not be terribly meaningful as intelligent memory systems develop, and bubble packaging will also tend to confuse the issue. In addition, bubble memory has potential advantages in terms of reliability, performance and packaging which will make it a strong competitor in certain areas prior to the time it is competitive on a bit-by-bit cost basis.

- IBM intends to sell large scale commercial mainframes. It is their "nearest and dearest" market. The venture into communications through Satellite Business Systems (SBS) supports this approach. With that understood, it is possible to speculate on the critical strategy of on-line storage.

  - The 8100 "Information System" has maximum storage of 320 million bytes.

  - The 4300 Series (4341) has up to 18 billion bytes of storage.

  - The "H" Series is rumored to have a maximum of 96 million bytes of main memory.

  - It is obvious that the "H" Series will support more on-line storage than the "E" Series (4300); the question is how much?

  - Since the "H" Series is to be announced in the 1980 timeframe, the technology will be magnetic disk. Based on maximum main memory size, INPUT beleives the "H" Series will offer between 219 and 438 billion bytes of on-line storage.

- The availability of such massive main memory and disk storage raises questions as to how it will be used. Possible (and even probable) ways are:

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- Applications data base processor or intelligent controller to support current and future data management functions.

- Backup and extension of storage and processing for distributed nodes.

- Introduction of new technology (probably bubbles) in back end and front end processors to improve performance and extend the storage hierarchy.

- It is also probable that bubble technology will be introduced as a substitute for disk at remote nodes early in the 1980s, consider the 8100 (or any new follow-on cluster controller).

  - The disk storage is currently integrated into the processor or I/O controller and costs approximately $.0019 per bit. Bubbles will be cost justified by the early 1980s.

  - This has decided advantage in terms of reliability, maintainability, and performance (more terminals and devices could be driven).

- Disk storage on the 4300 series will probably be impacted by bubble memory in the mid-1980s, with obvious advantages more than compensating for any cost differential.

- By the late 1980s, all disk memory will be subject to the impact from bubble technology on a cost basis and will start to be phased out on host systems.

3. PRINTER TRENDS

- Since DDP implies that processing will be brought into the office environment, it is possible to forecast printer trends with a relatively high degree of surety.

  - Office quality output is essential.

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- Multiple, quiet, relatively low speed printers, conveniently located, are superior to centralized high speed facilities.

- However, IBM strategy will probably be to have the best of both possible worlds. Therefore, the following will likely occur:

  - Impact printers will continue to be sold on distributed systems, even as IBM develops and announces a wide variety of more exotic print systems, such as the 6670 information distributor.

  - Since SNA will continue to emphasize large host systems, there will be a visible need for high speed printers during the early 1980s and IBM will market the 3800 (or follow-on system) as the obvious answer.

- The economics of paper output is such that the cost of the hardware represents less than 25% of the cost of printing. The major expenses are supplies (including paper) and physical handling. There is an increasing awareness of true printing expense among large users. In addition, the cost of supplies and personnel will continue to increase much more rapidly than hardware.

- The visible cost and impracticality of printing will continue to increase at large central sites in the early 1980s as the super systems are installed. Consider the following:

  - To print out the contents of 438 billion bytes of on-line storage would take over 6,000 hours (or 250 days) at 10,000 lines per minute.

  - The resulting amount of paper (full pages) would stretch for over 13,000 miles.

  - The cost (including paper and handling) would be approximately $2,000,000.

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- The cost of central site printing will become so apparent in the early 1980s that IBM will recommend distributing the printed output using SBS.

  - This will result in more IBM revenue from printers.

  - It will substitute satellite communications cost for physical handling (central site operators and courier or postage).

  - It will obscure the high paper volumes and expense by spreading it over many locations.

- By the mid to late 1980s, it will become apparent that a primary expense of running offices is the physical handling of paper.

  - IBM will encourage electronic offices to promote terminal sales. The objective will be to put one on every desk.

  - New storage devices will definitely be cheaper than paper filing; so the reduction in paper use will also increase the sale of storage devices.

  - However, printer sales will continue to increase through the 1980s despite the decreased paper volume. Distributed printing will require more printing devices, not fewer.

4. TERMINAL TRENDS

- IBM's new terminal product announcements (3279 color and 3211 ASCII) have had a dramatic impact on both user and competitor.

- With rapidly rising labor costs, coupled with double digit inflation, a low cost IBM display will gradually replace older 3277s and stimulate new applications. The ability to economically convert manual/mail systems to on-line systems will drive new orders.

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- It is estimated that all U.S. PC terminal vendors will ship a total of 275,000 units during 1979, up from 90,000 units in 1977. IBM will account for 175,000 units (64% of 1979 shipments): this is in the U.S. market only.

  - Assuming no component delays or unresolvable technical problems, IBM could build its base from 175,000 units for the U.S. market during 1979 to 225,000 in 1980.

- The 3277 base, estimated to be 450,000 worldwide units, will continue to provide excellent gross margins because of depreciated book value and continued demand. The demand remains high because the total market is expanding faster than new products can be delivered.

- Additional revenue will be generated by IBM through the outright sale of 3277s to users. As shown by past actions, and as new products attain quantity shipments, IBM will greatly reduce the purchase price and allow accumulated purchase option credits (POCs) to be applied towards the lower purchase price.

  - With accumulated POC's applied towards purchase, 3277's will be purchased in the range of $1,800-$2,000.

- This strategy will provide IBM with additional cash, contain 3277 base erosion, reduce competitive actions, and, in effect, makes competition struggle for 3278 business.

  - Regardless of the seemingly insurmountable obstacles confronting the PC vendors, the sheer size of the CRT market makes it attractive for the competition.

- The 3270, as it was originally introduced, was IBM's only general display system. It was sold as part of both of IBM's major computer systems - the System/370 and the System/3.

- By 1975, three major developments changed IBM's overall approach.

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- Significant penetration of the IBM display market by PCs.

- Minicomputers were being used increasingly in business applications, all using non-IBM displays.

- Communication systems technology matured to the point that large networks, supporting many types of terminals and processors, were being planned.

- IBM has reacted to competitive pressures by:

  - Enhancing SNA to support large, complex networks.

  - Ensuring that each new terminal or processor be supported within SNA.

  - Bringing out a wide variety of processors to compete for a large segment of the minicomputer market.

  - Introducing a variety of terminals and displays having different features and attachment protocols.

The result of the 8100, 4300, 3279 and the 3211 has been the creation of a huge new market for display stations.

- The following points are key to IBM's strategies:

  - The 8100 will support the new 8775 but it will also support the 327X IDS. A new model of the 3276 can be attached to the new local loop adapter. The older 3277s can also be attached.

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- The 433X processors support all the communications and display devices supported by the System/370. In addition, the 4331 has an integrated display adapter for up to 15 displays or printers without a control unit. It also has an integrated communications adapter for low cost communications with another CPU, or with 3276s or 3274s.

- The 3270 family of displays is, therefore, the major benefactor of the new market opportunities.

- It will be several years (at least five) before IBM can deliver all the 8100s and 4300s in the backlog. During that time, the ship rate for displays can be expected to increase each year.

- These products are indicative of IBM's movement away from the hierarchical system network architecture to a new distributed architecture under the SNA banner.

- Remote batch terminal devices will be affected by not only the 8100, but by the desire to have programmable devices.

  - It is estimated that non-programmable RBTs are experiencing an average annual growth rate (AAGR) of negative -25%, while programmable RBTs (not counting the 8100) are growing at 15% AAGR.

- In spite of the new IBM terminal configurations and their price/performance, the terminal market holds a bright future for PC vendors.

  - Users have accepted non-IBM terminals in large quantities. Compatible terminals are easier to sell then peripherals or mainframes.

  - IBM is reluctant to provide special terminal features (via RPQ), whereas PC vendors will often do so.

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- A non-IBM terminal is frequently not perceived by the data processing management as a potential maintenance problem in the same class as central site equipment.

F. IBM's SNA STRATEGY AND STATUS

- When IBM announced SNA (Standard Network Architecture) it was apparent to many observers that, despite paying lip service to distributed data processing (DDP), both the network architecture and the hardware products would not support very much distribution of function from host computers.

  - In fact, INPUT predicted in early 1976 ("Economics of Computer Communications Networks and Their Future Impact") that both the 3704/5 and 3790 would have to be replaced because of competitive pressures.

  - That the 3790 survived so long, and the 3705 (an even weaker device) is still being sold, seems a tribute to either IBM's strength in the marketplace or its technical stubborness.

- IBM is not a philanthropic organization. Its primary strength has been in making money and controlling field marketing and technological innovations. Since the announcement of SNA, IBM has "dragged its feet" on distributed processing, principally for financial reasons. Any significant move would have impacted revenues and profits and, therefore, the original SNA strategy has continued for four years despite:

  - The 3790 was strictly a cluster controller and not suited to meet the threats of full function minicomputers being proposed for DDP. In addition, it was not especially successful in the marketplace.

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- The 3704/5 has been a technological "nothing" and is subject to replacement by any number of competitive communications front ends. In addition, users have clamored for more function since the day it was announced. In fact, the IBM sales force has practically begged for a replacement.

- IBM development teams working with major users reported the inadequacy of the SNA hardware and software support in implementing major applications systems.

- Numerous surveys revealed customers were frustrated with IBM's networking efforts and were not accepting SNA.

- SNA is still an evolving product within a strategically defined framework. For many large users of data communications and IBM mainframes, the most significant benefit from SNA has been the ability to use SDLC - the full duplex line protocol.

  - A unique characteristic of domestic U.S. lease line tariffs accounts for the desirability of a full duplex protocol. Namely, the communications user is charged no more than 10% for a full duplex line over the price for a half duplex line. Therefore, SDLC was a major economic benefit offered by IBM with SNA.

- Converting an existing network and attendant applications to SNA can be extremely expensive.

  - Currently, less than 10% of IBM communications users have elected to implement SNA, including SDLC, in a live working environment.

  - An additional 10% have tried, or are trying, to test SNA with varying degrees of success. Results to date indicate that the most promising results are centered on new applications.

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- Conversion of older programs and/or upgrading of terminals to SNA is often too costly. The benefits derived from reduced line costs are not enough to offset reprogramming, additional hardware equipment costs, and additional support and training costs.

- IBM has acknowledged the reluctance of the user to embrace SNA. As a result, IBM has enticed users with additional incentives in the guise of the Advance Communications Functions (ACF).

  - ACF provides users with the ability to interconnect terminals and display stations to programs in one or more CPU's within a given network.

  - Additional incentives by IBM to convert to SNA allow 3270 BSC users to also take advantage of the CPU network connections.

- SNA is not a defined product. Rather it is an IBM strategy built around a communications framework. The objectives and derived benefits available to IBM from implementing SNA strategies are as follows:

  - Consolidate all communications developments into two defined products, namely, VTAM and SDLC. Currently, IBM supports over 30 communications access methods and more than 20 line protocols.

  - Capture a larger share of the communications terminal market with SNA. Prior to the announcement of System/370 and 3270 IDS, IBM terminals and displays accounted for only 40% of the total units attached to IBM CPU's.

  - Along with the 3279, 3211, 8100, and 4300 CPU announcements, IBM commenced to aggressively sell SNA.

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- The majority of the terminals were designed to work with SNA - SDLC only. User reluctance to readily embrace SNA forced IBM to provide BSC mode support as well.

- SNA provided the capability to interface terminals and CPU's together in a common network.

- As IBM moves again towards a variety of CPU types, coupled with a growing population of new terminals, it will become increasingly desirable for IBM to allow all units the same line protocols and message procedures as defined by the SNA disciplines.

- Competitive impacts must be minimized. In the U.S. marketplace, IBM recognizes AT&T as its most formidable threat. AT&T's in-depth resources, plus its dedication to achieving dominance in the data communications markets, influences IBM's strategies tremendously.

- IBM will concentrate on converting users to SNA and dedicated networks before AT&T can gain market momentum with its Advanced Communications Service (ACS).

- Once a user has converted to SNA, ACS is not an alternative because reprogramming costs would be prohibitive and because the private network is already in operation.

- From AT&T's view, its strategy for selling against IBM and SNA will be:

  . Lower conversion costs to ACS.

  . Support of all types of terminals and CPUs within ACS.

  . Ease of network implementation.

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. Complete user flexibility and minimal dependence upon IBM.

- Other possible competitors to IBM, particularly in the minicomputer and/or terminal markets, are reluctant to confront SNA. Not only are they concerned about taking IBM head on and the tremendous resources required, but IBM's past history of continually announcing new products and upgrades to existing ones keeps competition at bay.

- IBM will evolve SNA from a dogmatically hierarchical network, controlled only by a host CPU to a distributed network architecture. This will allow 8100s and 4300s to be used as node processors. Software to implement this will all be billable, and it will permit IBM users to effectively use distributed data processing (DDP).

- As a result, IBM's strategic manipulation of SNA and its ability to control users, places SNA as a strong defensive weapon as well as a superior offensive weapon.

- IBM can be expected to expand its sphere of influence most aggressively into the distributed data processing (DDP) marketplace.

- The recent announcements of various small processors such as the 8100, 43XX, System/38, and Series I ure prime examples of IBM's dedication to achieve market superiority in DDP.

- The DDP entries utilize a commonality of components, most noticeably the new IBM 64K RAM for main memory and common peripheral units. The combination of common memories throughout, coupled with interchangeable peripherals, not only results in reduced product costs but provides an abundant product mix which is difficult for any PC vendor to compete against.

- Large, inexpensive memories are necessary for DDP. The SNA control procedures, whether in an access method, such as, VTAM and NCP or in new software for the 8100 and the System/38, require large amounts of memory.

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- Only by providing large amounts of inexpensive memory will IBM be able to direct DDP into the SNA environment - from a customers' perspective.

- Without an available and acceptable SNA, IBM has been most reluctant to pursue the DDP market. Previously, it has been too easy for a user to interface a non-IBM minicomputer as a distributed processor using a bisync, or even an asynchronous, protocol.

- This situation is rapidly changing. Now that IBM is fostering the concept of DDP, many users will be influenced and begin seriously considering DDP. IBM will ensure that only SNA users will be able to assimilate the new DDP system.

- Satellite Business Systems (SBS) is part of IBM's strategy to additionally develop business in the U.S., and, potentially, in foreign markets.

- SBS will support data, voice, video, and facsimile. Further, it is expected IBM will support SNA users and actively guide them towards SBS services. Non-SNA users will experience more problems in utilizing the SBS attachment.

- IBM will devote whatever resources are required to ensure the market success of SNA. A series of announcements are planned to guarantee market acceptance and customer implementation.

- However, SNA will not come free. On the contrary, the customer will pay handsomely for the cost of software to offset lower hardware prices and reduced revenues.

- This strategy allows IBM to exert price pressures on all PC vendors. Vendors are reluctant to incur software development costs but would rather allow their users to run IBM's available software offerings.

- IBM will be expected to counter by moving from readily available software to increasingly more comprehensive software that is costly and/or difficult for vendors to run on their equipment.

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- INPUT believes that SNA usage will grow to where over 50% of all large communications users will be using SNA by 1983.

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APPENDIX A: USER RESPONDENT DATA

EXHIBIT A-1

CPUS INSTALLED OR ON ORDER BY RESPONDENTS (NUMBER OF UNITS)

CPU TYPE	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
IBM 3033	–	–	11	11	–	–	8	8
IBM 3032	–	–	2	2	–	–	2	2
IBM 3031	–	–	11	11	–	2	3	5
IBM 370/195	–	–	1	1	–	–	–	–
IBM 370/168	–	–	9	9	–	–	–	–
IBM 370/165	–	–	1	1	–	–	–	–
IBM 370/158	–	–	36	36	–	1	–	1
IBM 370/155	–	–	1	1	–	1	–	2
IBM 370/148	–	7	4	11	–	–	–	–
IBM 370/145	–	8	1	9	–	2	–	2
IBM 370/138	–	15	–	15	–	–	–	–
IBM 370/135	–	18	4	22	–	–	–	–
IBM 370/125	–	6	–	6	–	2	–	2
IBM 360/75	–	–	1	1	–	–	–	–
IBM 360/65	–	–	1	1	–	–	–	–

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EXHIBIT A-1 (CONT.)

CPUS INSTALLED OR ON ORDER BY RESPONDENTS (NUMBER OF UNITS)

CPU TYPE	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
IBM 360/50	1	–	–	1	–	–	–	–
IBM 360/40	5	–	–	5	–	–	–	–
IBM 360/30	11	–	–	11	–	–	–	–
IBM 360/20	3	–	–	3	–	–	–	–
IBM SYSTEM 38	–	–	–	–	5	–	–	5
IBM SYSTEM 34	3	1	–	4	6	–	–	6
IBM SYSTEM 3/X	33	1	25	59	–	–	–	–
IBM SERIES 1	4	–	–	4	1	–	–	1
IBM 4341	–	–	–	–	6	34	16	56
IBM 4331	–	–	–	–	12	13	–	25
IBM 4300	–	–	2	2	–	–	8	8
IBM 8100	–	–	–	–	–	–	13	13
NON-IBM	2	1	3	6	–	–	–	–
TOTALS	62	58	113	233	30	55	50	135

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EXHIBIT A-2

DISK DRIVES INSTALLED OR ON ORDER BY RESPONDENTS (NUMBER OF UNITS)

DISK TYPE	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
IBM NOT SPECIFIED	4	6	–	10	2	–	15	17
IBM 2311	29	–	–	29	–	–	–	–
IBM 2314	49	1	3	53	2	–	–	–
IBM 2319	3	6	–	9	–	–	–	–
IBM 3033	–	20	–	20	–	–	–	–
IBM 3310	–	8	4	12	4	–	–	4
IBM 3330	–	66	324	390	–	8	–	8
IBM 3333	–	–	15	15	–	–	–	–
IBM 3340	48	119	198	365	16	5	–	21
IBM 3344	8	48	4	60	2	5	–	7
IBM 3348	2	–	–	2	–	–	–	–
IBM 3350	–	22	492	514	2	18	74	94
IBM 3370	–	3	–	3	20	13	3	36
IBM 3371	2	–	–	2	–	–	–	–
IBM 3410	–	–	–	–	4	–	–	4

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EXHIBIT A-2 (CONT.)

DISK DRIVES INSTALLED OR ON ORDER BY RESPONDENTS (NUMBER OF UNITS)

DISK TYPE	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
IBM 3650	–	–	3	3	–	–	–	–
IBM 3675	–	–	3	3	–	–	–	–
IBM 3850	–	–	1	1	–	–	–	–
IBM 5340	2	–	–	2	–	–	–	–
IBM 5440	8	–	–	8	–	–	–	–
IBM 5444	18	–	–	18	–	–	–	–
IBM 5445	6	–	–	6	–	–	–	–
IBM MISC.	37	–	–	37	6	16	–	22
CDC 2314	–	–	4	4	–	–	–	–
CDC 3330	–	–	16	16	–	–	–	–
CDC 3333	–	–	10	10	–	–	–	–
CDC 3350	–	–	6	6	–	–	–	–
CDC MISC.	2	–	48	50	–	–	–	–
CALCOMP 230	–	6	–	6	–	2	–	2
DEC ROK-7	–	4	–	4	–	–	–	–

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EXHIBIT A-2 (CONT.)

DISK DRIVES INSTALLED OR ON ORDER BY RESPONDENTS (NUMBER OF UNITS)

DISK TYPE	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
H-P	-	-	3	3	-	-	-	-
ITEL 3101	3	-	-	3	-	-	-	-
ITEL 3330 PC	-	14	62	76	-	-	-	-
ITEL 7330	-	7	98	105	-	-	10	10
MEMOREX 3330	-	34	-	34	-	-	-	-
MEMOREX 3350	-	-	3	3	-	-	10	10
MEMOREX 3675	-	-	16	16	-	-	-	-
STC	-	-	-	-	-	-	15	15
STC 3330	-	-	20	20	-	-	-	-
STC 3350	-	-	20	20	-	-	-	-
STC 8350	-	-	20	20	-	-	-	-
STC 8650	-	-	-	-	-	-	2	2
TELEX 3330 PC	-	-	-	-	-	2	-	2
TELEX 3350 PC	-	8	12	20	-	2	-	2
TOTAL	221	386	1,435	2,042	58	69	129	256

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EXHIBIT A-3

TAPES INSTALLED OR ON ORDER BY RESPONDENT SIZE (NUMBER OF UNITS)

TAPE TYPE	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
IBM NOT SPECIFIED	1	17	-	18	-	-	-	-
IBM 1600 BPI	-	-	14	14	-	-	-	-
IBM 2303	-	-	1	1	-	-	-	-
IBM 240X	28	9	20	57	2	-	-	2
IBM 2415	1	-	-	1	-	-	-	-
IBM 32XX	3	-	3	6	-	-	-	-
IBM 331X	-	3	3	6	-	-	-	-
IBM 33XX	-	5	7	12	-	-	-	-
IBM 34XX	20	142	368	530	1	20	5	26
IBM 3803	-	-	1	1	-	-	-	-
IBM 5444	2	-	-	2	-	-	-	-
IBM 6250	-	-	12	12	-	-	-	-
IBM 8809	-	2	-	2	2	4	-	6
IBM SUBTOTAL	55	178	429	662	5	24	5	34

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EXHIBIT A-3 (CONT.)

TAPES INSTALLED OR ON ORDER BY RESPONDENT SIZE (NUMBER OF UNITS)

TAPE TYPE	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
CDC 3420	-	2	-	2	-	-	-	-
CALCOMP 3420	-	4	-	4	-	-	-	-
DEC	-	3	-	3	-	-	-	-
H-P	-	-	1	1	-	-	-	-
ITEL 7420	-	12	-	12	-	-	-	-
MEMOREX	-	3	26	29	-	-	-	-
POTTER 2400 SERIES	6	-	-	6	-	-	-	-
STC	-	3	136	139	-	-	-	-
STC MOD5	-	-	19	19	-	-	-	-
STC 3420	-	-	32	32	-	-	-	-
STC 3430	-	4	-	4	-	-	-	-
STC 3450	-	8	-	8	-	-	-	-
STC 3650	-	-	8	8	-	-	-	-
TELEX 6420	-	-	16	16	-	-	-	-
GRAND TOTAL	61	217	680	958	5	24	5	34

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EXHIBIT A-4

PRINTERS INSTALLED OR ON ORDER BY RESPONDENTS (NUMBER OF UNITS)

PRINTER	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
IBM 1401	1	–	1	2	–	–	–	–
IBM 1403	44	44	50	138	1	–	–	1
IBM 1404	–	–	1	1	–	–	–	–
IBM 3203	–	15	11	26	1	4	6	11
IBM 3211	–	2	45	47	–	1	–	1
IBM 3262	1	–	–	1	1	3	–	4
IBM 2203	4	–	–	4	3	–	–	3
IBM 3289	–	1	–	1	–	1	–	1
IBM 3741	2	–	–	2	–	–	–	–
IBM 3800	–	–	10	10	–	–	3	3
IBM 3811	–	–	1	1	–	–	–	–
IBM 5203	3	–	–	3	–	–	–	–
IBM 5210	1	–	–	1	–	–	–	–
IBM 5211	2	–	–	2	1	–	–	1
DOCU-MATION	–	–	23	23	–	–	–	–

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EXHIBIT A-4 (CONT.)

PRINTERS INSTALLED OR ON ORDER BY RESPONDENTS (NUMBER OF UNITS)

PRINTER	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
DATA 100	–	–	1	1	–	–	–	–
DECISION DATA	2	–	3	5	–	–	–	–
PARADYNE	–	–	2	2	–	–	–	–
DEC	–	1	–	1	–	–	–	–
HONEY-WELL	–	–	–	–	1	–	–	1
XEROX	1	–	–	1	–	–	–	–
BST	1	–	–	1	–	–	–	–
TOTALS	62	63	148	273	8	9	9	26

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EXHIBIT A-5

TERMINALS INSTALLED OR ON ORDER BY RESPONDENTS (NUMBER OF UNITS)

TERMINALS	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
IBM 1060	–	24	–	24	–	–	–	–
IBM 12XX	5	–	–	5	12	–	–	12
IBM 2980	12	88	–	100	–	–	–	–
IBM 327X	93	834	3,128	4,055	50	269	591	910
IBM 328X	–	13	43	56	–	44	–	44
IBM 34XX	–	16	–	16	2	–	–	2
IBM 36XX	8	12	600	620	–	–	191	191
IBM 3705	–	135	2	137	–	9	–	9
IBM 374X	18	45	–	63	–	–	–	–
IBM 37XX	–	–	30	30	–	–	–	–
IBM 4277	14	–	–	14	–	–	–	–
IBM 52XX	26	–	–	26	11	–	–	11

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EXHIBIT A-5 (CONT.)

TERMINALS INSTALLED OR ON ORDER BY RESPONDENTS (NUMBER OF UNITS)

TERMINALS	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
IBM 7860	–	15	–	15	–	–	–	–
IBM MIXED	25	18	6,707	6,750	11	8	8	27
ATM	3	–	10	13	–	–	–	–
ANDERSON	–	–	25	25	–	–	–	–
BELL	6	–	–	6	–	–	–	–
BUNKER RAMO	–	64	120	184	–	24	180	204
COLT	–	–	1	1	–	–	–	–
COMPUTER OPTICS	–	–	70	70	–	–	–	–
DATA-POINT	–	–	4	4	–	–	–	–
DATA GENERAL	–	–	2	2	–	–	–	–
DEC	–	30	81	111	–	–	–	–
DATATROL	–	–	450	450	–	–	–	–
DATA DECISION	5	–	–	5	–	–	–	–
GENESIS	7	10	25	42	–	–	–	–

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EXHIBIT A-5 (CONT.)

TERMINALS INSTALLED OR ON ORDER BY RESPONDENTS (NUMBER OF UNITS)

TERMINALS	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
GE	–	1	–	1	–	–	–	–
HARRIS	–	–	224	224	–	6	32	38
HAZELTINE	2	9	–	11	12	–	–	12
ITT COURIER	12	77	324	413	–	54	11	65
H-P	–	1	9	10	–	–	–	–
FOUR-PHASE	–	–	80	80	–	–	12	12
KODAK COMSTAR	–	–	2	2	–	–	–	–
LEAR SIEGLER	20	–	–	20	–	–	–	–
MEMOREX	3	18	203	224	–	65	–	65
PARADYNE	–	11	–	11	–	–	–	–
RAYTHEON	–	–	22	22	–	–	–	–
TI	–	–	200	200	–	–	–	–
TELEX	18	12	23	53	6	–	–	6
TEKTRONIX	–	–	26	26	–	–	–	–

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EXHIBIT A-5 (CONT.)

TERMINALS INSTALLED OR ON ORDER BY RESPONDENTS (NUMBER OF UNITS)

TERMINALS	INSTALLED				ON ORDER			
	SMALL	MEDIUM	LARGE	TOTAL	SMALL	MEDIUM	LARGE	TOTAL
TYMSHARE PRIME	9	-	-	9	-	-	-	-
TELETYPE	-	-	25	25	-	-	-	-
WORD-STREAM	-	94	40	40	-	4	-	4
TOTAL	299	1,527	12,482	14,308	128	483	1,025	1,636

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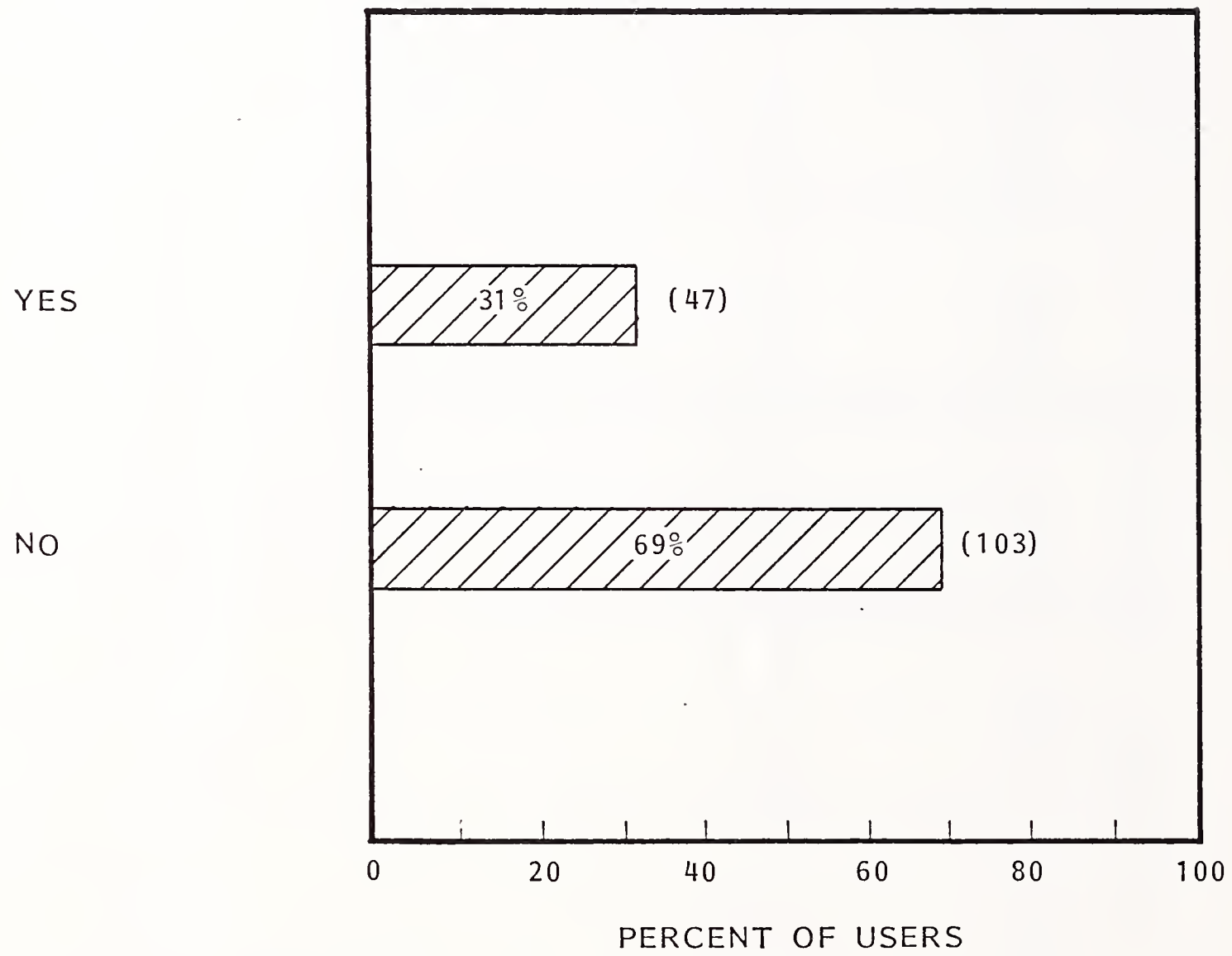
EXHIBIT A-6

RESPONDENT USERS
PERCENT OF RESPONDENT USERS WITH IN-HOUSE TIMESHARING



NUMBER OF RESPONSES = 150

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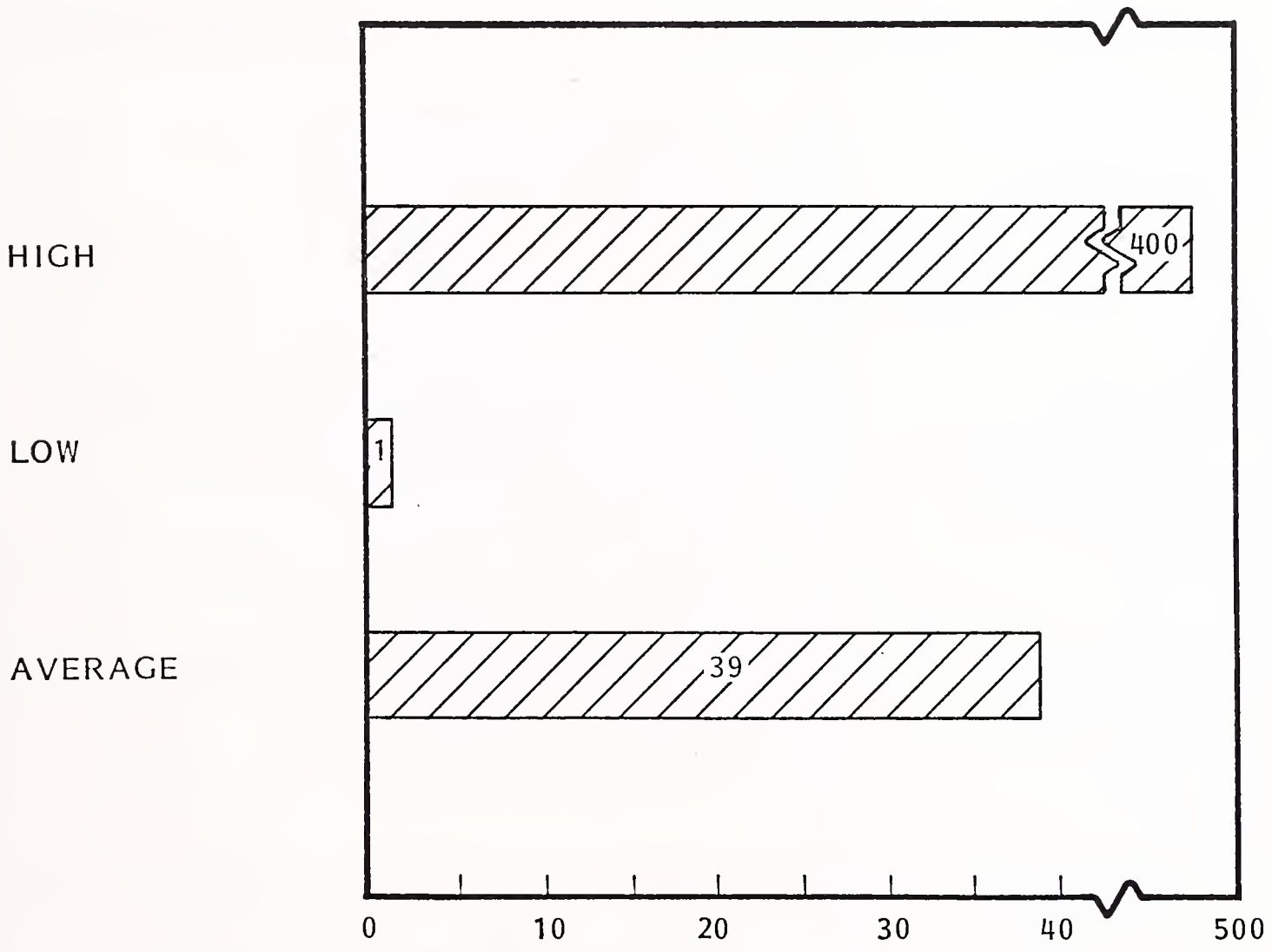
EXHIBIT A-7

RESPONDENT USERS
AVERAGE NUMBER OF TIMESHARING USERS
ON-LINE AT ANY ONE TIME



NUMBER OF RESPONSES = 47

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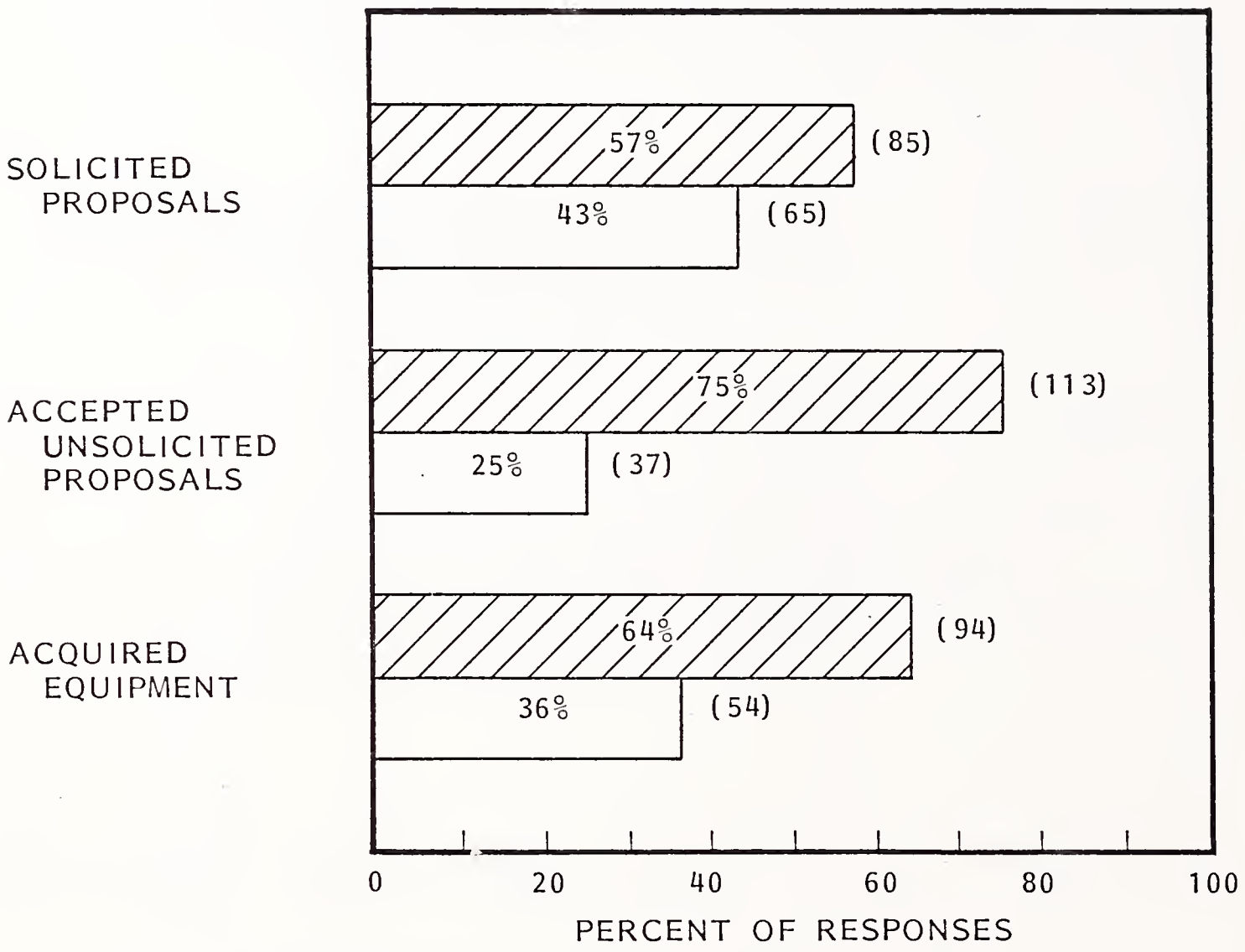
EXHIBIT A-8

RESPONDENT USERS
ACTIONS REGARDING ACQUISITION OF PC/PCM EQUIPMENT



NUMBER OF RESPONSES = 150

YES
NO

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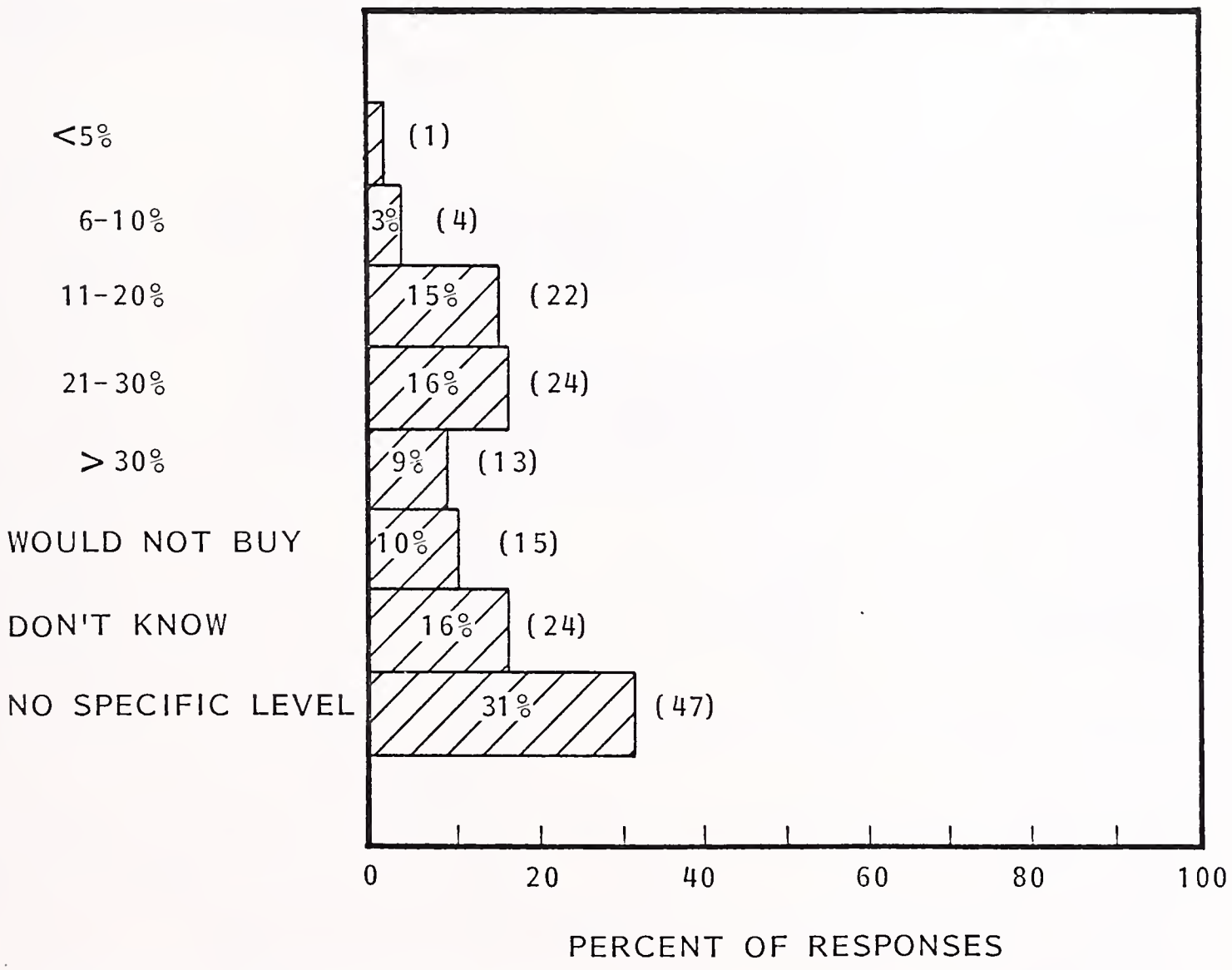
EXHIBIT A-9

RESPONDENT USERS
PRICE SAVINGS LEVELS REQUIRED TO
PURCHASE PC/PCM EQUIPMENT



NUMBER OF RESPONSES = 150

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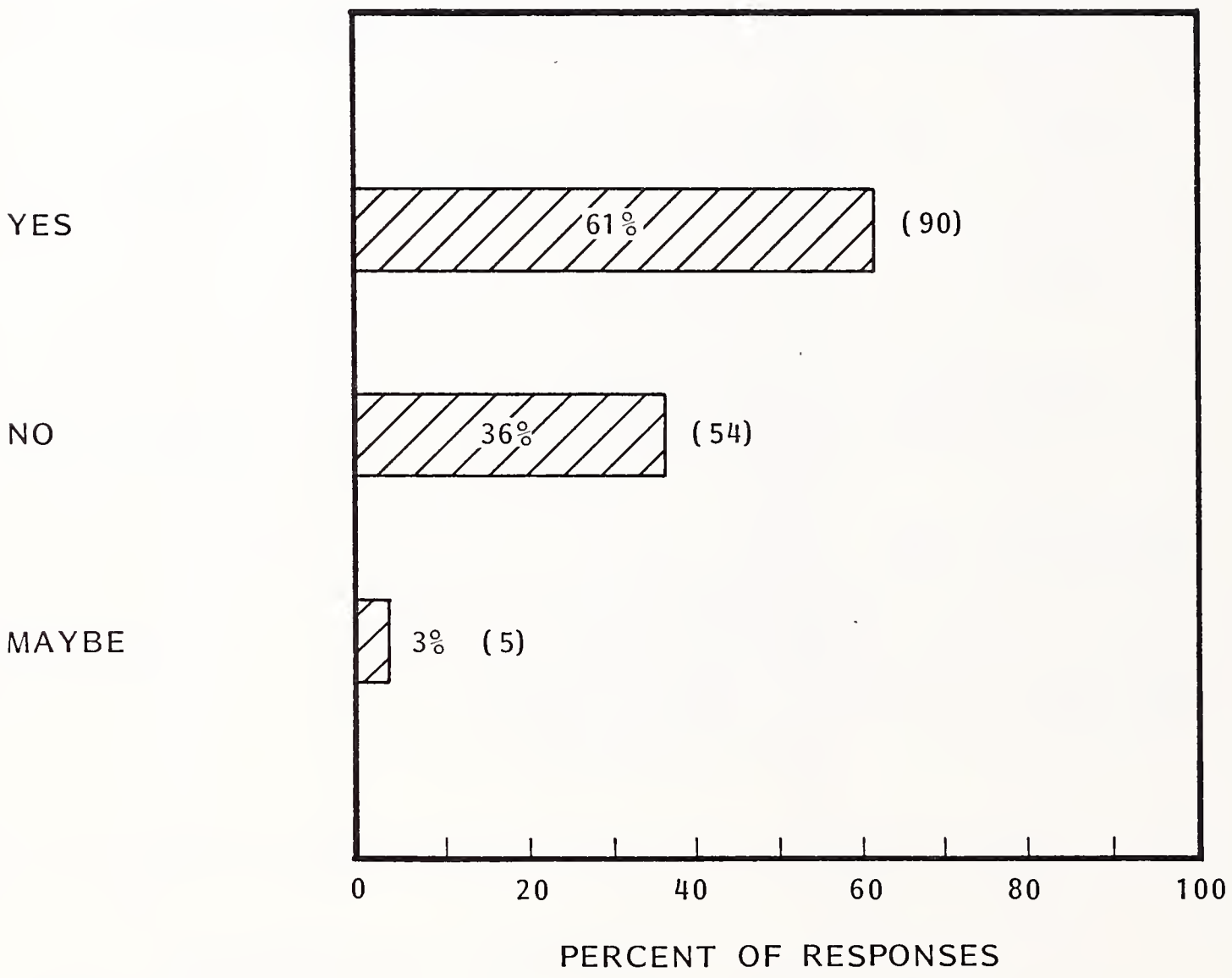
EXHIBIT A-10

RESPONDENT USERS

RESPONDENT USERS' WILLINGNESS TO ACCEPT

NEW NON-IBM TECHNOLOGY PRODUCTS



NUMBER OF RESPONSES = 149

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EXHIBIT A-11

RESPONDENT USERS

RESPONDENT USERS' PERCEPTION OF PC/PCM VENDORS' OFFERINGS OF EXPANDED PRODUCT LINES

PLUG COMPATIBLE VENDOR OFFER	IMPORTANT		SOMEWHAT IMPORTANT		NOT IMPORTANT		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
PERIPHERALS ONLY	24	17%	12	8%	107	75%	143
MAINFRAME ONLY	12	9	12	9	117	82	141
MAINFRAME/ PERIPHERALS	23	16	19	13	101	71	143
ALL ABOVE PLUS SOFTWARE	45	31	13	9	86	60	144

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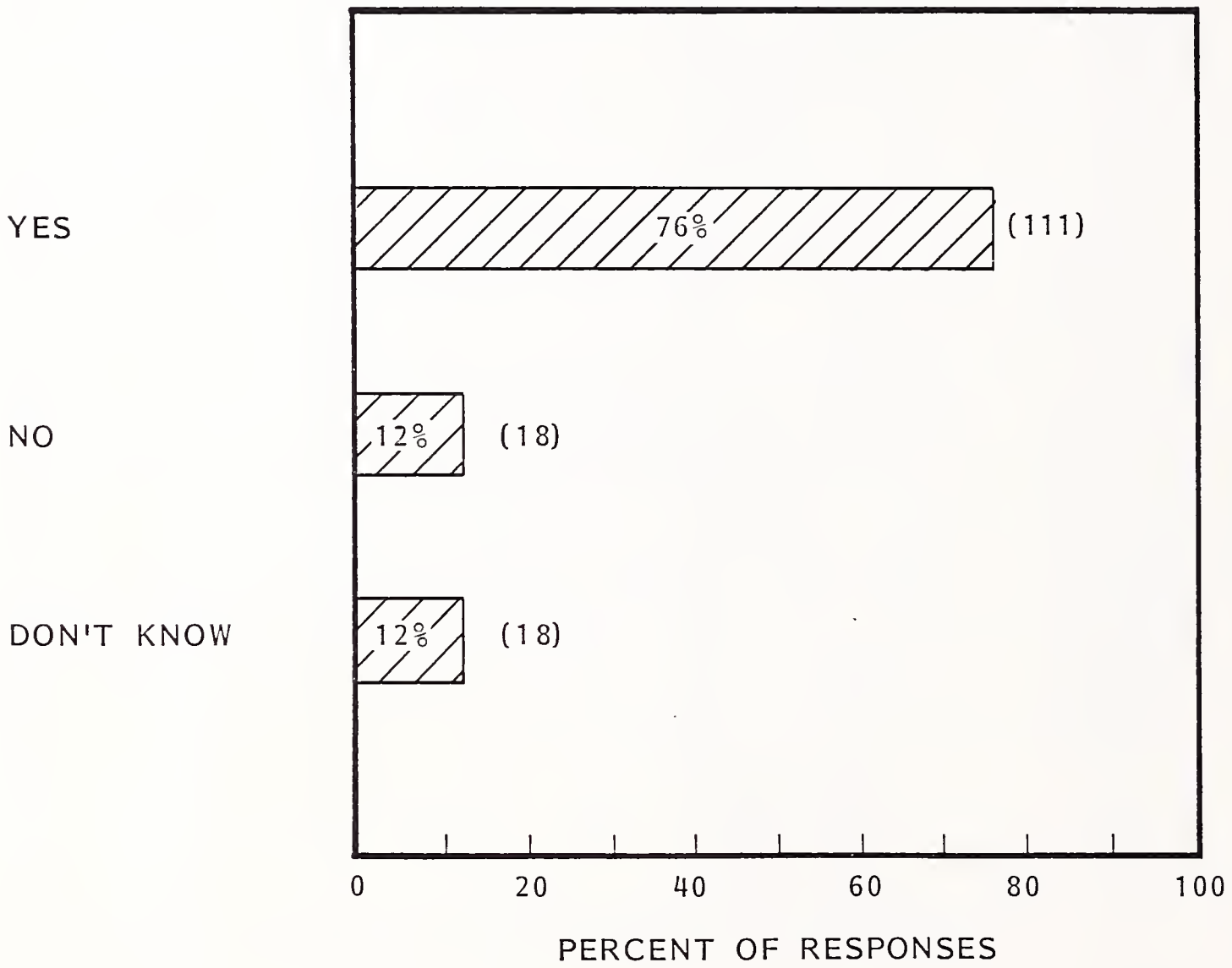
EXHIBIT A-12

RESPONDENT USERS

RESPONDENT USERS' PERCEPTION OF JAPANESE COMPUTER/ PERIPHERAL INDUSTRY AS A POSSIBLE CONTENDER IN THE U.S. MARKETPLACE



NUMBER OF RESPONSES = 147

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EXHIBIT A-13

RESPONDENT USERS
ANALYSIS OF RESPONDENT USERS'
TAPE LIBRARIES

MAGNETIC TAPE STORAGE	HIGH	LOW	AVERAGE	TOTAL NUMBER OF RESPONSES
TOTAL TAPE REELS IN LIBRARY	55,000	-	3,829	146
TAPE REELS FOR STORAGE	18,500	-	1,772	115
PERCENTAGE OF TAPE REELS UTILIZED FOR DATA	100%	3%	39%	106

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EXHIBIT A-14

RESPONDENT USERS

RESPONDENT USERS' ACTION TO INCREASE OR DECREASE THE NUMBER OF DISK FILE DATA SETS

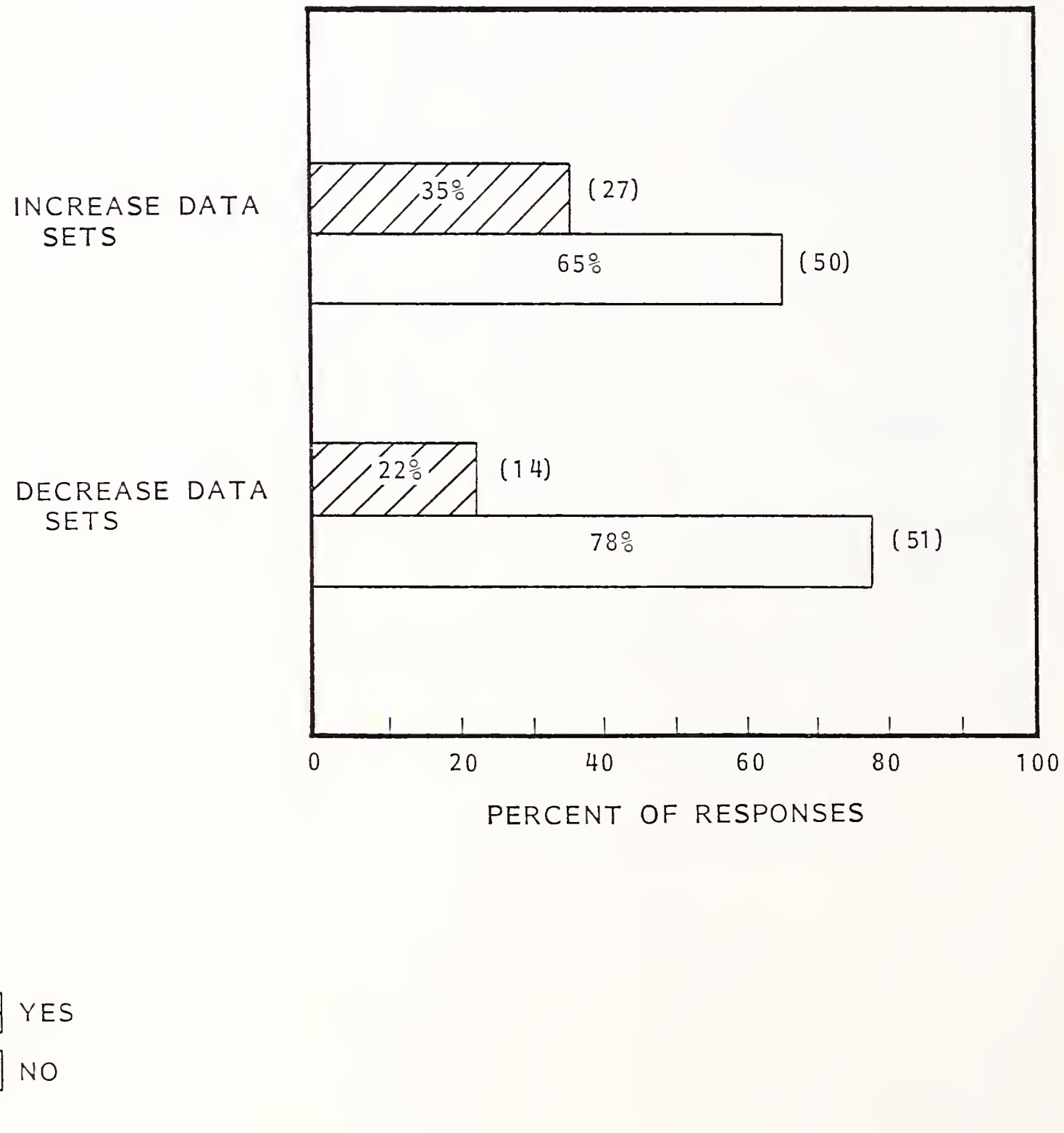

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EXHIBIT A-15

RESPONDENT USERS

STATUS OF BACKUP RECOVERY SYSTEM FOR ON-LINE STORAGE

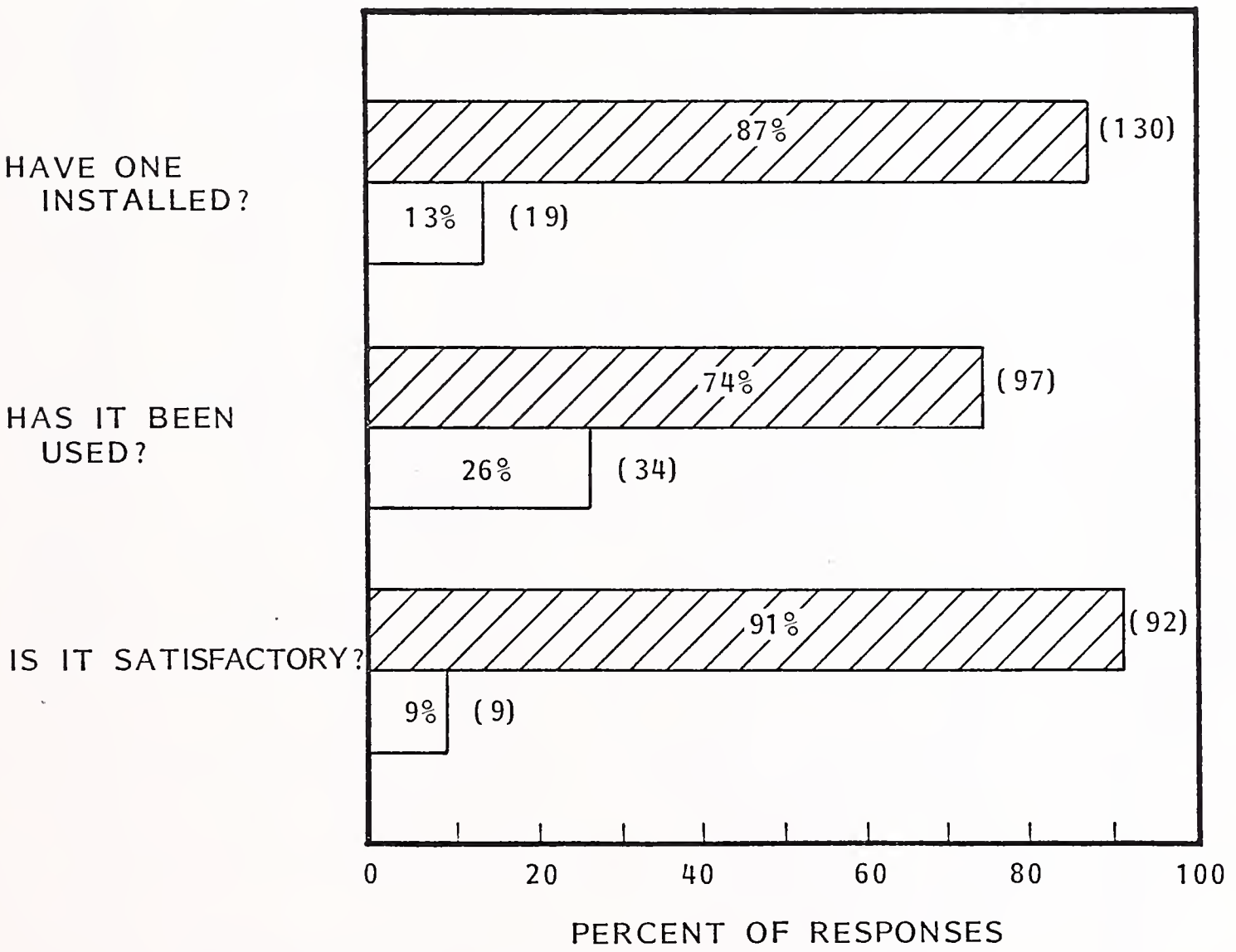

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EXHIBIT A-16

RESPONDENT USERS

PROJECTIONS OF NEW IBM TECHNOLOGIES IN THE 1980-1981 TIMEFRAME

TECHNOLOGY ADVANCE	YES		NO		DON'T KNOW		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
BUBBLE MEMORIES	81	55%	38	26%	29	19%	148
CHARGE COUPLED DEVICES	24	16	26	18	98	66	148
FLAT PLANE GAS DISCHARGE CRTS	39	27	18	12	90	61	147
HARDWARE DBMS	81	55	25	17	42	28	148
THIN FILM HEADS FOR TAPES	33	22	14	10	100	68	147

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EXHIBIT A-17

RESPONDENT USERS

REACTION TO THE CONCEPT OF INDUSTRY ARCHITECTURAL STANDARDIZATION

QUESTION	YES		NO		DON'T KNOW		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
WILL THE INDUSTRY BENEFIT?	100	70%	34	24%	9	6%	143
WILL THE USER BENEFIT?	104	72	35	24	5	4	144

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EXHIBIT A-18

RESPONDENT USERS

ATTITUDES TOWARD SOURCE OF MAINTENANCE

SOURCE OF MAINTENANCE	YES		NO		MAYBE		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
MIXED IBM AND PC OPERATING TODAY	75	51%	72	49%	-	-	147
CONSIDER CONTRACTING ALL MAINTENANCE TO PC SUPPLIER	14	18	52	68	11	14	77
CONSIDER CONTRACTING TO PC SUPPLIER IF IBM A SUBCONTRACTOR	26	35	37	49	12	16	75

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EXHIBIT A-19

RESPONDENT USERS

WILLINGNESS TO PARTICIPATE IN MAINTENANCE TASKS

WOULD USER BE WILLING TO:	DO IT YOURSELF?		COOPERATE WITH VENDOR		NOT AT ALL		TOTAL NUMBER OF RESPONSES
	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	NUMBER OF RESPONSES	PERCENT	
RUN DIAGNOSTICS?	74	52%	48	33%	22	15%	144
REPLACE BOARDS?	54	38	39	27	50	35	143
DELIVER/PICK UP TO CENTRAL REPAIR DEPOT?	23	16	27	19	93	65	143
COMPONENT LEVEL REPAIR?	10	7	18	13	116	81	144

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APPENDIX B: QUESTIONNAIRES

CATALOG NO. XPC[ ][ ][ ]

PLUG COMPATIBLE - USER QUESTIONNAIRE

I.

1. For the purpose of this survey, this company is classified as:

   ☐ Large (IBM 158+)

   ☐ Medium (IBM 125 to 148)

   ☐ Small (IBM GSD type products; i.e., Series 1, 38, etc.)

2. Please describe your installed data processing equipment and equipment presently on order (include CPU, disk, tape, printers, terminals, etc.):

Equipment Type	Vendor Name	(8) Model	(9) Quantity	(10) Installed	(11) On Order	Delivery Date
CPU						
Disk						
Tape						
Printer						
Terminal						

2. Please describe hardware acquisition plans for 1980 through 1984, excluding equipment currently on order:

Type of Equipment	Year of Anticipated Acquisition

3. a. Do you have in-house timesharing?
   1 Yes
   2 No (go to 4) (12)

   b. If yes, what is the average number of users on-line at any one time?
   _____ (13)

   c. Will this number increase or decrease over time?
   1 Increase
   2 Decrease
   3 No Change (14)

   d. How much will it increase/decrease?
   _____ % (15)

4. a. Do you normally purchase your equipment?
   1 Yes
   2 No (16)

   b. If yes, what type of equipment (CPU, tapes, software, etc.)?

   _____

   _____

   _____

   _____

   c. In light of recent announcements and reduced prices, will you change the way that you handle terms of equipment procurement?
   1 Yes
   2 No (17)

   d. If yes, what type of equipment (CPU, tapes, software, etc.)?

   _____

   _____

   _____

   _____

II.

1. With regard to plug compatible (PC) equipment or plug compatible mainframes (PCM):

a. Have you solicited proposals for such devices? (18)
1 Yes
2 No

Why? _____

_____

_____

b. Would you accept a proposal from such a vendor? (19)
1 Yes
2 No

Why? _____

_____

_____

c. Have you acquired such equipment? (20)
1 Yes
2 No

Why? _____

_____

_____

d. What level of savings or price improvement would cause you to order PC/PCM? (21)
1 5%
2 10%
3 20%
4 30%
5 > 30%
6 Would Not Buy
7 Don't Know

2. Describe the strengths and weaknesses of each PC/PCM vendor with whom you are familiar. In each case, what in your opinion should the vendor do to make his products more attractive to you?

3. a. Would you accept a new technology product offered by a PC vendor prior to IBM offering the same product (i.e., bubble memory, CCD, etc.)?

1 Yes
2 No

(22)

b. If no, why? _____

4. PC vendors products normally sell for lower prices than those offered by IBM. What in your opinion are the three primary reasons that allow them to offer lower prices?

_____

_____

_____

_____

_____

_____

5. In your opinion, how important is it that a: (Circle one)

		Important	Somewhat Important	Not Important	
a.	PC vendor offer peripherals only	1	2	3	(23)
b.	PCM vendor offer mainframe only	1	2	3	(24)
c.	PCM vendor offer mainframe/ peripherals	1	2	3	(25)
d.	PCM vendor offer all above plus software	1	2	3	(26)

6. Assume a PCM vendor desired to enhance his product line by offering "extras" such as proprietary software or specialized storage devices, can you list those extras that you feel would be the most important to you?

_____

_____

_____

_____

_____

7. What recommendations would you make to the following classes of PC vendors for you to buy their product?

Disk Drives _____

_____

Tape Drives _____

_____

Printers _____

_____

Terminals (non-intelligent) _____

_____

Large Mainframe (158+) _____

_____

Mid-Range Mainframe (125-148) _____

_____

Add-On Memory _____

_____

8. In your opinion, which PC vendors offer viable alternatives to IBM and why?

_____

_____

_____

_____

_____

_____

_____

9. In your opinion, which PC vendors are likely not to survive in their field and why?

10. Do you consider the Japanese computer/peripheral industry to be a possible contender in the U.S. marketplace?

(27) 1. Yes 2. No

If yes, in what product areas?

If no, why?

II.

1. How do you view the concept of mass storage as a utility to you? (Circle appropriate answer)

   1 Mostly archival (28)

   2 Intermediate element of a storage hierarchy (disk highest, tape lowest)

   3 A fundamental element of a totally on-line storage system

   4 Other _____ (specify)

2. a. Please estimate the number of tape reels in your tape library: (Includes active, storage, programs, etc.)

   _____ (29)

   b. Of this number, how many are just storage? _____ (30)

   c. Please estimate the effective percent of tape per reel that is actually utilized for data?

   _____ % (31)

3. Considering disk and tape as a combined storage medium, please break down the percent of total storage capacity on tape and on disk:

	Now		1984	
(32) Tape	_____	%	(34) _____	%
(33) Disk	_____	%	(35) _____	%
	100	%	100	%

4. Please estimate the effective percent of disk actually utilized for storage of data:

   _____ % (36)

5. a. By what percent will on-line storage increase:

By year end 1980 _____ % (37)

By year end 1984 _____ % (38)

b. Is this growth the result of: (Circle all that apply)

1 New applications (39)

2 Increasing TSO file

3 Other _____
(specify)

6. a. For on-line storage, are you doing anything to increase the number of data sets? 1 Yes 2 No (40)

Please elaborate: _____

_____

b. Are you doing anything to decrease the number of data sets? 1 Yes 2 No (41)

Please elaborate: _____

_____

_____

7. a. Do you have a system for backup/recovery of on-line storage? 1 Yes 2 No (42)

b. Have you had to use it? 1 Yes 2 No (43)

7. c. If yes, are you satisfied with its operation? 1 Yes 2 No (44)

d. If no, why? _____

_____

_____

_____

8. a. What kinds of software or firmware tools would you like to see developed to assist in storage management?

_____

_____

_____

b. Would you expect the mainframe vendor to supply these? 1 Yes 2 No (45)

c. If yes, would you expect IBM to supply these? 1 Yes 2 No (46)

d. If no, why? _____

_____

_____

_____

IV.

1. What changes do you expect to see in IBM's provisions for storage hierarchy and memory management in systems of your class?

_____

_____

_____

_____

_____

_____

2. Do you believe IBM will introduce any of the following new technologies or systems into production equipment within the next two years?

Technology	(Circle One) Yes	No	Don't Know	Where	
Bubble Memories	1	2	3		(47)
CCDS	1	2	3		(48)
Flat Plane Gas Discharge CRT	1	2	3		(49)
Hardware DBMS	1	2	3		(50)
Thin Film Heads for Tape	1	2	3		(51)

3. a. What is your reaction to the concept of architectural standardization?

_____

_____

_____

_____

b. Do you think the industry will benefit from it? 1 Yes 2 No (52)

Why? _____

_____

_____

_____

c. Do you think you will benefit from it? 1 Yes 2 No (53)

Why? _____

_____

_____

_____

V.

1. Describe systems software presently being used:

Type of Software (DBMS, Operating System, etc.)	Name of Software	Software Vendor

2. a. Do you plan to change/add systems software in the next _____ years? (55)

1 Yes
2 No (go to 3)

(54)

b. If yes, why? _____

_____

_____

_____

c. Will this software be used for present or on-order equipment?

1 Present
2 On-Order

(56)

3. What major applications are planned for installation in:

1980 _____

_____

_____

1981 thru 1984 _____

_____

_____

_____

_____

4. a. Do you acquire your current systems software from a:

		Vendor Type	Estimated Annual $	
(57)	1	Mainframe Vendor		(58)
	2	Non-Mainframe Vendor		(59)
	3	Independent Contractor		(60)
	4	Other _____ (specify)		(61)

4. b. Do you anticipate changes in these divisions by year end 1981?

1 Yes
2 No (go to 5)

(62)

c. If yes, how will they change and why?

	Vendor Type	Estimated Annual $	Why
(63) 1	Mainframe Vendor	(64)	
2	Non-Mainframe Vendor	(65)	
3	Independent Contractor	(66)	
4	Other _____ (specify)	(67)	

Comments: _____

_____

_____

_____

_____

5. a. Do you acquire your applications software from a:

	Vendor Type	Estimated Annual $
(68) 1	Mainframe Vendor	(69)
2	Non-Mainframe Vendor	(70)
3	Independent Contractor	(71)
4	Internal Developments	(72)

5. b. Do you anticipate changes in these divisions by year end 1981? (73)
   1 Yes
   2 No (go to 6)

   c. If yes, how will they change and why?

	Vendor Type	Estimated Annual $	Why
(74) 1	Mainframe Vendor	(75)	
2	Non-Mainframe Vendor	(76)	
3	Independent Contractor	(77)	
4	Internal Development	(78)	

6. List any systems software packages you would like to have: (Note: get vendor name as well as package name)

7. a. Do you have a data base management system installed? (79)
   1 Yes
   2 No (go to 7e)

   b. If yes, which one? _____ (80)
   Name/Vendor

   c. What is its most important feature?

   _____

   _____

   _____

   d. What is its greatest shortcoming?

   _____

   _____

   e. What are your future plans for DBMS?

   _____

   _____

8. a. Do you have a storage manager software package installed? (81)
   1 Yes
   2 No (go to 8e)

   b. If yes, which one(s)?

   1 ASM2

   2 HSM

   3 DMS/OS (82)

   4 D FAST/VS

   5 Other _____
   (specify)

   6 DMS

   c. What is its most important feature?

   _____

   _____

   _____

8. d. What is its greatest shortcoming?

_____

_____

e. What are your future plans for a storage manager software package?

_____

_____

9. a. Do you have a security package installed? 1 Yes 2 No (83)

b. If yes, which one?

1 RAEF
2 ACFZ (84)
3 SECURE
4 Other _____ (specify)

c. What is its most important feature?

_____

_____

d. What is its greatest shortcoming?

_____

_____

e. What are your future plans for a security package?

_____

_____

10. a. Would you buy a compatible operating system from other than IBM? 1 Yes 2 No (85)

b. Why? _____

_____

_____

VI.

1. a. Are you familiar with IBM's new concept of systems support centers?
   1 Yes
   2 No (go to 2) (86)

   b. If yes, have you had any experience with these centers?
   1 Yes
   2 No (87)

   c. If yes, describe your reaction (good, bad, etc.):

_____

_____

_____

_____

2. a. Is your DP shop mixed with IBM and PC equipment?
   1 Yes
   2 No (go to 4) (88)

   b. If yes, would you consider contracting all maintenance to one of your PC suppliers?
   1 Yes
   2 No
   3 Maybe (89)

   c. Explain why: _____

_____

_____

3. a. Would you consider contracting all maintenance to one of your PC suppliers if IBM equipment is maintained by subcontract to IBM?
   1 Yes
   2 No
   3 Maybe (90)

   b. Explain why: _____

_____

_____

4. Remote diagnostics (RD) will be increasingly employed by all vendors. In your opinion, how will RD impact your operations? (benefits/ problems)

_____

_____

_____

_____

_____

_____

_____

_____

5. To what level are you willing to participate in the maintenance process?

	Do It Yourself	Cooperate With Vendor	Not At All	
Run Diagnostics	1	2	3	(91)
Replace Boards	1	2	3	(92)
Delivery/Pickup to Central Repair Depot	1	2	3	(93)
Component Level Repair	1	2	3	(94)

CATALOG NO. XPC

PLUG COMPATIBLE - VENDOR QUESTIONNAIRE

1. What types of IBM compatible products does your firm market?

Type	Your Model Number	IBM Model Number	Performance Percent of IBM	Price Percent IBM	
				Rent	Purchase
CPU					
Disk					
Tape					
Printer					
Terminal					

2. By type of product that you market, what are the three major advantages over IBM? (List in order of major advantage)

CPU _____

_____

Disk _____

_____

Tape _____

_____

Printer _____

_____

Terminal _____

_____

3. By type of device that you market, who are your major competitors? Rank from most major to least major and explain why?

CPU _____

_____

Disk _____

_____

Tape _____

_____

Printer _____

_____

Terminal _____

_____

4. By type of product you market, what is your estimate of the total units shipped and your percent of the market for:

	Units	Market Percent
1978	_____	_____
1979	_____	_____
1980	_____	_____
1981	_____	_____
1982	_____	_____
1983	_____	_____
1984	_____	_____

5. By type of product that you market, list the three major changes you expect in technology in the coming years?

Type	Two Years	Five Years
CPU		
Disk		
Tape		
Printer		
Terminal		

5. a. What will be the impact on the user from these changes? (Same format as 5 previous page)

b. Quantify these technology changes in the form of disk density packing, tape densities, printer method and speeds, transfer rates, etc. (Same format as 5 previous page)

6. In your market areas, what announcements do you expect from IBM and when?

6. a. What will be your response to these new products?

7. Due to recent IBM announcements, what in your opinion is the future for PC/PCM companies? Why?

8. In your opinion, what PC/PCM firms offer the best viable alternatives to IBM? Why?

CPU _____

_____

Disk _____

_____

Tape _____

_____

Printer _____

_____

Terminal _____

_____

9. Is there another industry shake out coming?

☐ Yes ☐ No

a. If "Yes", what vendors in your opinion will drop out? _____

_____

_____

b. What vendors will be merged or acquired? _____

_____

_____

c. If "No", why? _____

_____

_____

10. What problems or opportunities have been presented to your firm by the announcement of the 4300?

a. What has been your planned or announced reaction to these announcements?

11. When do you believe the H Series will be announced?

a. When announced, what are your three major concerns relative to that product's impact on you?

11. b. How will you respond to the announcement?

12. If the 4300 offers 4:1 price performance over the 370/148, what in your opinion will be the H series' price performance as it relates to the 3033?

13. In your opinion, what will be the three major features of the H Series?

13. a. What will be your reaction to these features?

b. What advantages do you see for the user?

c. What are some of the disadvantages you foresee for the user?

14. The H Series may have increased the channel rates and parallelism (two bytes wide). How would this affect you?

14. a. What will be your reaction?

15. What are the three largest growth areas for your devices or technologies?

a. How did you conclude these are the largest growth areas?

16. In your opinion, from a user's viewpoint, what are the three major factors he should consider in hardware selection?

_____

_____

_____

_____

a. Do you believe the user would use the same criteria as you?

☐ Yes ☐ No

If "No" explain why? _____

_____

_____

_____

17. As an overview, in your opinion where is the PC/PCM market headed?

_____

_____

_____

_____

a. What must the vendors do to remain a viable alternative?

_____

_____

_____

_____

18. In your opinion, in view of the present situation, if this had been projected five years ago, would your firm be in the PC/PCM business?

☐ Yes ☐ No

a. Explain: _____

_____

_____

_____

19. Do you believe that IBM will or will attempt to make it impossible to run their software on any CPU other than those of their manufacture?

☐ Yes ☐ No

a. If "Yes," by what method(s)? _____

_____

_____

_____

_____

b. If this is accomplished, what will you do to handle this problem or opportunity?

For operating systems _____

_____

_____

For utilities _____

_____

_____

For communications _____

_____

_____

For applications _____

_____

_____

20. In your opinion, is the market moving towards a system sale rather than a box sale?

☐ Yes ☐ No

Explain why: _____

_____

_____

_____

21. In your opinion, how should your firm change its approach to the market and products over the next five years to maximize profit and market penetration?

_____

_____

_____

_____

_____

_____